JOURNAL OF THE

SMPTE

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Progress Committee Report for 1959

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Introduction

The advent of 1960 brought to a close a decade during which many interesting things took place in both the motion-picture and television fields. Early in the fifties 3D arrived, enjoyed a brief flurry of popularity, and departed. Many wide-screen processes were developed or revived and negative/positive color came into general use.

During this decade great advances were made in the development of television. Color television was pretty well standardized after a false start, although it remains for the "sizzling sixties" to see it generally accepted.

Nothing really new happened in the motion-picture field in 1959, unless one counts movies with smells, and this so-called novelty was really only a revival. In the field of television few, if any, developments could be described as "new."

Many improvements were made in both arts, and these are described in other sections of this Report. The motion picture lost some of its importance in the overall field of entertainment although there was an increase in theater attendance; this trend is expected to continue.[1,2] Installations of 70mm projection equipment continued to increase with, of course, a corresponding increase in wide-film production.[3,4] Large studios placed less emphasis on engineering[5] while other fields of motion pictures and television continued to develop.

Seventy per cent of the television programs for 1959–1960 were on film[6] which makes motion pictures important in that field and has resulted in crowded Hollywood facilities.[7]

The tenth anniversary of TV's real start toward its present importance—catering to what the industry claims is 85% of the population in 44 million homes[8]—may be said to have occurred in 1959.

A number of theaters were remodeled and brought up to date.[9–12]

Movie makers outside of the U.S. got into the U.S. market via the commercial route.[13] Religious film makers found moral punch themes in demand for religious films.[14] With new activities, Hollywood is expected during the 60's to "boom" again.[15,16] A survey by the British Kinematograph Society showed that next to stars the public wanted color in films.[17] Motion-picture exports for films and equipment were lower in 1959 than in 1958, but raw stock showed a substantial increase, especially in 8mm and 16mm.[18]

In 1959 more firms used film to promote products and help train employees as shown in another section of this Report and by other published information.[19]

Eight millimeter continued to gain in importance as evidenced by the large amount of new equipment offered, including the 8mm sound projector.

Submitted March 17 to April 8, 1960, by Lloyd Thompson, Committee Chairman, c/o The Calvin Company, 1105 Truman Rd., Kansas City 6, Mo. The Committee makes an annual report, this report covering the calendar year 1959.

Fig. 1. Mole-Richardson Type 1963 Fogmaker Moleffect.

Video tape was widely used in 1959 and a number of taped shows were brought to this country. Color video tape was used for a number of productions. Color continues to advance with more and more time being devoted to color programing.

Set Construction and Special Effects

A considerable number of new materials and processes related to set construction and special effects were introduced during 1959 but no truly basic inventions or changes can be reported.

Mole-Richardson Company introduced a new line of special-effects equipment known as Moleffects. The Type 1911 Cobweb Spinner (weight, 5 lb) will produce webs from either a rubber cement or a plastic base material. Available in kit form, complete with materials and carrying case, its components can also be purchased separately. The plastic cobwebbing material has found most favorable acceptance. An important advantage is that after the solvent has evaporated the web is completely flameproof, in contrast to rubber formulations. It can also be easily removed from surfaces. If not disturbed, the web will last for an almost indefinite time. The resin used for this purpose is a 20 to 25% solution of polyvinylidene chloride or Saran.[20]

The Type 1963 Fogmaker (Fig. 1) weighs 9 lb; dimensions are 11 by 5 by 13 in. This small portable unit can be used to produce fog; to clear the air of fog, smoke, haze or dust particles; and to dispense insecticides or deodorizing materials. This device is also available in kit form, or as separate components. As a fog-gun it works on the principle of a flashboiler. An insecticide, supplied with the kit, is especially useful because it is completely nontoxic to warm-blooded animals or humans, but most effective and deadly to insects.

The Type 1983 Mister Dyna-Fogmaker is a small portable fog generator of the pulse-jet engine type. Its weight is 17 lb and it is 61 in. long by 11 in. wide by 11 in. high. Its anodized aluminum back-pack tank for holding the liquid material weighs 6 lb empty and about 40 lb full. It is used to dispense large volumes of fog or insecticide.

The Type 1993 Senior Dyna-Fogmaker (Fig. 2) will dispense fog or insecticide in much the same manner as the Mister Dyna-Fogmaker, but on an even larger scale. It, too, operates on the jet-engine principle and has a 4-in. diameter exhaust port as compared to 1 in. for the smaller machine. The Senior Dyna-Fogmaker is 65 in. long, 17 in. wide, 27 in. high and weighs 100 lb. Its 55-gal steel tank has a plastic-treated lining and holds sufficient material for 1½ to 12 hours of continuous fogging, depending upon the rate selected.

The Type 1971 Windmaker[21] was developed to produce an increased rate of air flow with reduced noise as compared to other existing special-effect fans. It is approximately 12 db quieter than most studio fans of comparable size, has an 18-in. diameter fan blade, weighs 74 lb, and will operate from either a-c or d-c power supply. Speed may be smoothly adjusted throughout the speed range. The Windmaker may be mounted on either a Type 19720 Low Pedestal or Type 19721 High Pedestal, both with 4-in. locking casters.

In connection with fog-guns it should be mentioned that an excellent blue-dye oil fog was worked out and demonstrated using the flashboiler-type gun (described above) and work is in progress to extend the effects of colored smokes to various additional colors.[22] The formulation for these colored smokes encompasses new oil-soluble dyes as well as new oil-base vehicles.

A silver paint produced by du Pont[23] has been found useful in priming plastic surfaces to permit electroplating.

A texture paint, composed of reclaimed rubber filler with natural rubber latex used as a binder, can be compounded for troweling down to painting consistency and has been found extremely useful by at least one studio.[24] A vulcanizing agent added to the binder-filler formulation sets up the coating and provides it with excellent mechanical properties. The finished coating is extremely tough with an ideal "weight to strength" ratio. It will adhere to almost any surface and promises to find application in production work for both decorative and functional purposes.

The studios have, by now, quite generally accepted a chlorinated rubber coating as a sealer for hard flats in place of shellac, because it does not cause raising of the wood grain. It is also useful on dance and stage floors to prevent bleeding of colors.

A polyvinyl acetate water base emulsion paint[25] has been perfected to yield a clear coating with sufficiently high gloss to replace the use of inflammable hazardous solvent lacquers on stages and sets.

A formulation worked out for simulation of face or skin scars has found ready acceptance by the studios. It employs Zein (a protein) in an isopropyl alcohol/-water mixture. The compound is nontoxic and therefore applicable even close to the eye area.

Use of isophthalic polyester resin for making studio props and structures by casting or lay-up methods in conjunction with glass-fiber reinforcement has been suggested by the Research Council where such end products are exposed to water, since products made from this resin material do not cloud up like standard polyesters.[26]

An interesting use of expandable polystyrene beads has been worked out by one of the major studios. When the beads are imbedded in the latex used to produce seaweed, the beads will expand during the normal process of heat-curing of the latex casting. The result is a lowering in specific gravity, the beads providing sufficient buoyancy to cause the seaweed to float under or upon the surface of the water, as desired.[27]

Efforts to standardize materials and processes used in construction technology were made by the Research Council. While this is a difficult and rather involved task, it is expected that its successful completion would effect substantial financial savings and many other advantages.

Studio Lighting Equipment

The Mole-Richardson Co. (Hollywood) introduced the four-blade sliding barn door, an accessory for controlling the size and shape of the light beam from a set-lighting lamp. It mounts in the lamphead diffusion clips and can be rotated to any angular position. Mole-Richardson Types 40789, 41265 and 41572 are available for standard Baby, Junior and Senior Solarspot lamps, respectively.

The Century Lighting, Inc. C-Core lighting dimmers[28] first used in an installation at Yale University in 1958, are now available in capacities of 2, 3, 4, 5, 6, 8, 10 and 12 kw. These units, developed around the silicon controlled rectifier, are compatible with all Century remote-control lighting consoles which include the two-scene preset Theatron type, the multiscene preset C-1 type, and the infinite preset punch system.

Advantages of the C-core dimmer are cost savings; reduced weight, heat and noise; and increased flexibility and reliability.

Century Lighting, Inc., has developed a punch remote control lighting system with automatic infinite presetting and an infallible memory (Fig. 3). As part of Century Control Systems, this enables the scenic or lighting artist to create any complexity of lighting effects. There are

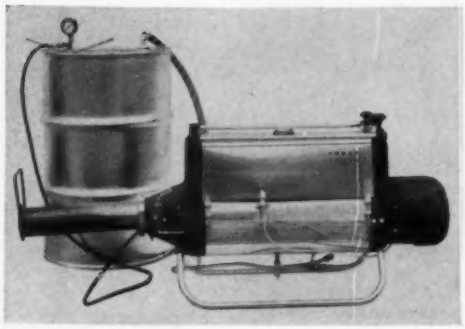

Fig. 2. Mole-Richardson Type 1993 Senior Dyna-Fogmaker Moleffect.

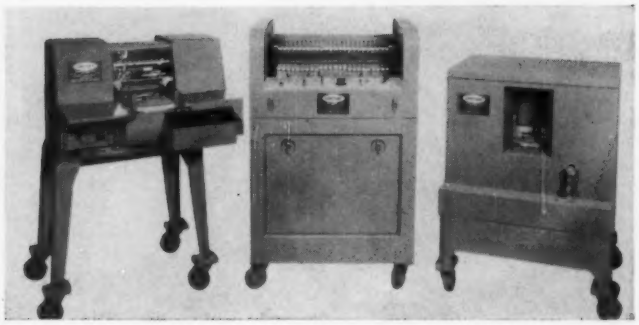

Fig. 3. Century Lighting automatic preset system components: left, card punching machine; center, punch control console; right, card reading machine.

no limits on the number of changes from one lighting effect to the next. The changes can be rapid and dynamic or gradual and subtle. They can be repeated with complete accuracy from performance to performance or from season to season. The lighting for any given scene or subscene can be immediately and accurately recorded. Standby rehearsal time formerly required for recording a given lighting setup is reduced to seconds.

Kliegl Bros. has developed a silicon controlled rectifier lighting dimmer[29] known as the SCR dimmer. The units are available in 2500-w, 4000-w and 10,000-w capacities. Their use (Fig. 4) in the recently constructed ABC-WXYZ facilities in Detroit is an example of their application. Advantages listed for the SCR dimmer as compared to other types of dimming controls are less weight, bulk, heat and noise; immediate response; infinite loading; excellent dimming curve; higher efficiency; and ability to combine into flexible arrangements with all system elements.

A lamp luminaire, called multi-PAR, was developed by General Electric Co.'s Large Lamp Department. The lamps in the luminaire are of the sealed-beam tungsten-filament type. Several sealed-beam lamps of the same type are mounted closely together in a fixture and aimed so that their axes converge at a common point. Designed especially for studio lighting applications, the equipment incorporates a step type of dimming control that does not alter the color temperature of the composite beam.[30]

Film

At the 1959 Fall Convention of the Society in New York, Eastman Kodak announced the introduction and showed demonstration prints made from a new high-speed color reversal film. Originally supplied under the name Eastman (or Kodak) Color Reversal Film, Types SO-260 and SO-270, it has now been given the official name of Eastman (or Kodak) Ektachrome ER Film, Types 5257 (35mm) and 7257 (16mm), and Types 5258 (35mm) and 7258 (16mm).

Types 5257 and 7257 designate the product which is balanced for daylight exposure conditions; whereas Types 5258 and 7258 are balanced for use with tungsten 3200 K illumination. The daylight-balanced film has an exposure index of 160 to daylight. The tungsten-balanced film has an exposure index of 125 to tungsten and 80 to daylight. A Wratten Filter No. 85B is used under the latter conditions of exposure.

The new materials find wide application for conditions where sufficient exposure cannot be obtained with slower speed color reversal films. Some of the applications include production of industrial pictures under existing plant illumination, photography of nighttime sporting events, high-speed photography by both daylight and artificial light and the making of color newsreels. Processing service is provided by certain Kodak Processing Laboratories, but the film may also be processed by the user, if desired.

The Gevaert Company of America introduced two new black-and-white camera reversal films during 1959: (1) Gevapan 30 Reversal Type 863, having exposure index values of 64 to daylight and 40 to tungsten illumination; and (2) Gevapan 26 Reversal Type 880 with indexes of 250 to daylight and 160 to tungsten. These materials have also been made available with magnetic striping. A new reversal color print material for color printing from reversal color originals was also announced — Gevacolor Duplicating Reversal Type 900.

Another new product is Gevaert Telerecording Reversal Type 850. This is a black-and-white medium-speed reversal film having blue and ultraviolet sensitivity. It has been used extensively in Europe for photography of TV picture tube images.

Editing

A 35mm film viewer announced by National Cine Equipment, NCE35, combines the functions of a viewer, synchronizer, footage counter and frame counter in one unit. The $3\frac{1}{4}$ by $4\frac{1}{4}$-in. picture is said to be clear and brilliant

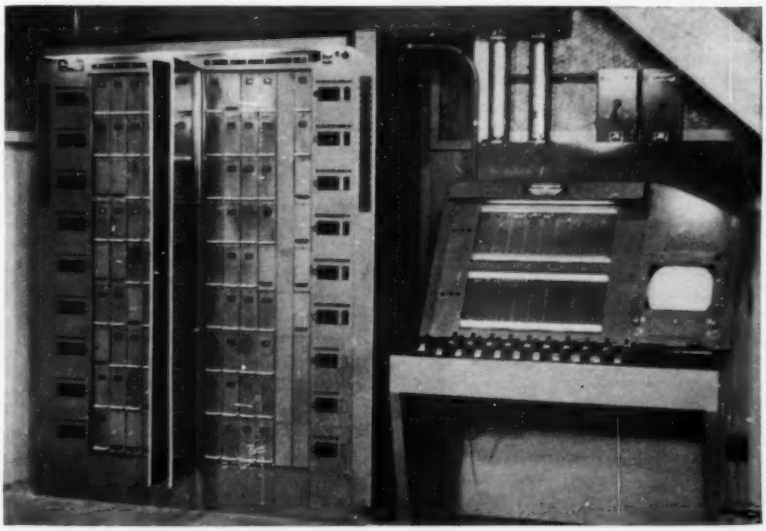

Fig. 4. Kliegl Bros. SCR lighting control system.

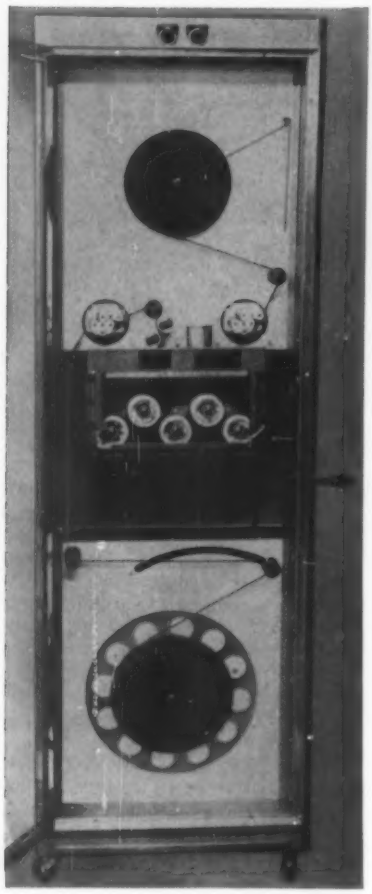

Fig. 5. Unicorn Model A-5100 motion-picture film cleaner.

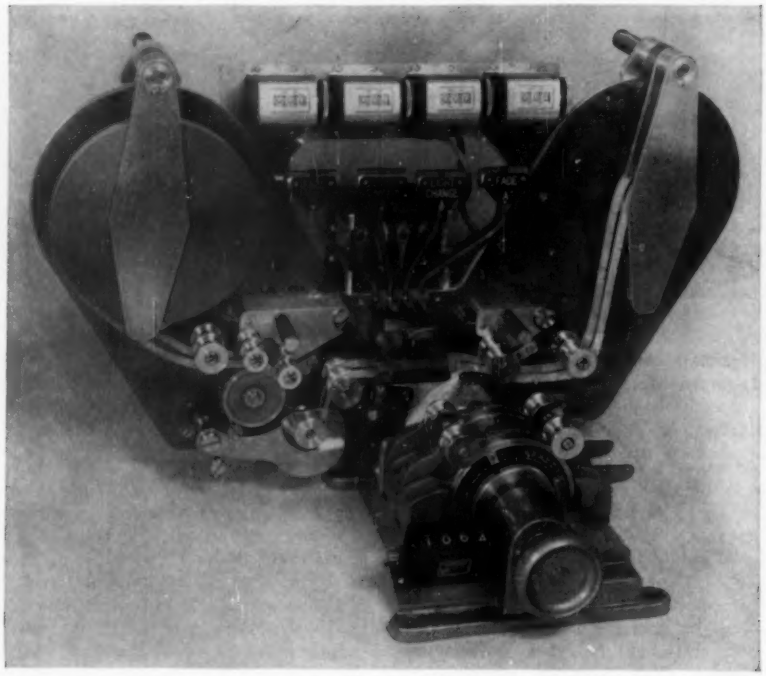

Fig. 6. Movielab A & B control strip punch with dual feed and takeup, punch actuating levers and individual cue counters.

in action or single frame.[31] S.O.S. Cinema Supply Corp. introduced a 3 by 4-in. picture area viewer with built-in focusing and framing controls. The lighthead can be lifted permitting an editing pencil to be used directly on the film surface.[32]

Processing Equipment

During 1959 Technicolor continued its expansion of wet printing facilities to permit making clean prints from all kinds of negative. Since its introduction in 1956 the wet printing procedure has been highly successful in eliminating the appearance on the screen of many negative defects in Technicolor imbibition prints. Most Technicolor matrix printers are now equipped for wet printing.

A third electronic timer is being added to Technicolor equipment to permit rapid handling of new negative. First installed in 1953 the electronic timers have been adapted to handle all types of commercial motion-picture negative such as 65mm, Technirama and 35mm now being processed through Technicolor.

Unicorn, a division of Computer Measurements Company, introduced the Model A-5100 series motion-picture film cleaner (Fig. 5). Film is cleaned by counter-driven velvet-covered rollers which are submerged in conventional, safe film-cleaning solvents (methylchloroform or Freon TF.). Protection from film damage is assured by a protective "solvent cushion" which forms between the film and rollers and permits only the velvet fibers to contact the film surfaces. The operating speed is variable (between 100 and 300 ft/min) to permit using the most efficient speed as determined by varying film conditions, the thoroughness of cleaning being inversely proportional to the film speed through the machine. Features include self-contained air and vacuum squeegees, 3000-ft film roll capacity, solvent and air filtering, controlled tension rewinds and special Unicorn safety devices. Operation is reported automatic and trouble free. These instruments are currently in use in commercial and television laboratories and military installations. Production hand cleaning of motion-picture film is no longer economically practical.

For some time a method of using a cue control strip for cuing light changes and fades or dissolves has been in use at Movielab (Fig. 6). This control strip run at 4-to-1 ratio with the film being printed makes the notching of the original negative unnecessary. To improve the accuracy and the ease of punching the control strips, a double or A & B control strip punch was designed and built so that the control strips for both the A & B negatives can be punched simultaneously. The two negatives are threaded over the two 16mm sprockets and the two control strips are punched at the proper point on either the A or B negative. Individual counters keep a record of the number of light-change and fade cues punched.

Since many powered rewinds are in constant use in the laboratory at Movielab and existing foot controlled rheostats or speed controls were found unsatisfactory due to their light construction and/or lack of true stepless control, a heavy duty treadle-type speed control was designed and built incorporating a variable transformer linked to the foot treadle with a quadrant gear and pinion (Fig. 7). A heavy-duty microswitch breaks the transformer circuit completely when the treadle is at the top of its travel. Strongly constructed of aluminum the speed controller has virtually eliminated maintenance and greatly improved the smoothness of operation of the powered rewinds.

To improve the quality of print inspection it is necessary that screen brilliance be carefully controlled within the standards accepted by the industry. To accomplish this, an iris light control was built at Movielab to fit the standard 16mm projector lenses in use. By adjusting the iris, the screen brilliance may be set to the desired reading and this maintained during the life of the projection lamp by readjustment of the iris opening.

To correlate all printing operations

Fig. 7. Movielab improved foot rheostat in use on positive finishing breakdown table.

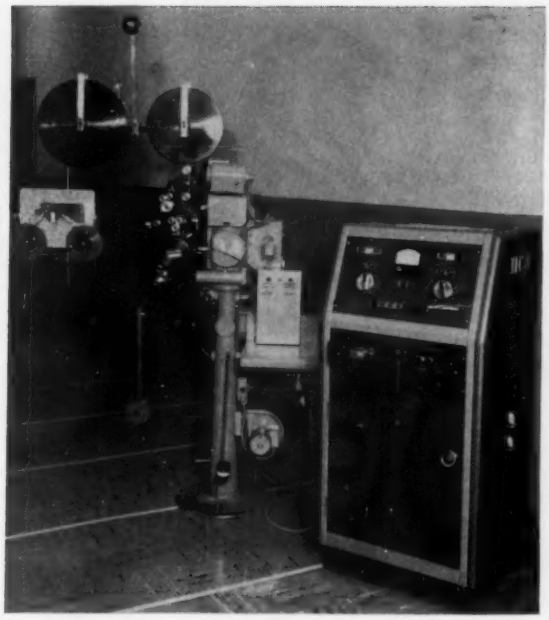

Fig. 8. Movielab printer control console.

at Movielab for both black-and-white and color film production and to augment further their automation program, printer control consoles have been constructed to centralize all control switches, tape readers for light changes, voltmeters and rheostats for lamp voltage control and cue controls on a single panel (Fig. 8). The black-and-white printer consoles for continuous printing incorporate either a Hurletron automatic shutter control or a Unicorn printer Robot memory unit to operate the automatic shutter unit installed on the printer. Heavy-duty rheostats are provided for trimming the lamp voltages to their normal setting. The lamp circuits also incorporate 24-position tap switches to provide calibrated 0.024 log E changes for adjustment of exposure to correct for emulsion changes and/or film type changes. Black-and-white printer consoles for reduction printers, such as the Depue, have an 8-bit, built-in Friden Motorized Tape Reader with a memory unit designed for resistance light changes. The resistance steps are calibrated for an 0.05 log E change to match those of the Hurletron or Unicorn automatic shutters. It may be noted that with the design and fabrication of these consoles, changes have been made in both the Hurletron and Unicorn readers. These have been altered to read a standard code established at Movielab for all perforated tape readers used in both black-and-white and color printer consoles.

The Houston Fearless Corp. EN-37 printer (16mm black-and-white) (Fig. 9) was developed for the Air Force. It features automatic exposure control within 4 frames at 60 ft/min over a negative density range of 0.3 to 2.0 on print stock made in accordance with Mil-F-0033 Type III Class G when developed to a gamma of 1.0.

Also featured is a self-contained transistorized lamp power supply, a preview station to read negative density when manual control is in use, adjustable torque motor take-ups, lamp voltage meter and voltage control and a film emulsion speed control.

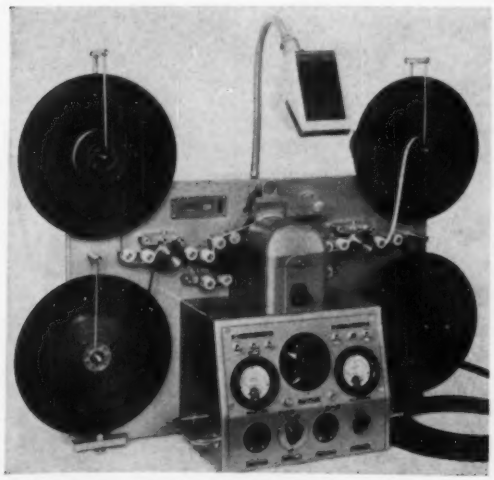

Fig. 9. Houston Fearless EN-37 printer.

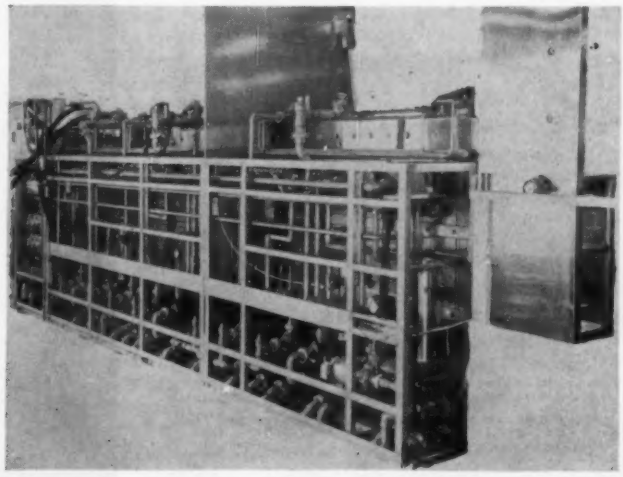

Fig. 10. Houston Fearless 35/70mm color film processor.

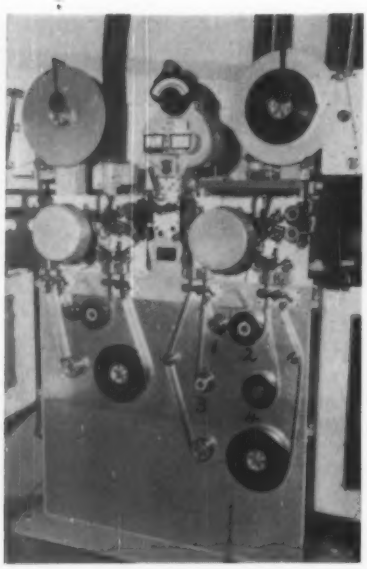

Fig. 11. Bell & Howell Model A automatic printer used at M-G-M Laboratories for subtractive printing of color films.

Modular-type construction is used throughout to facilitate darkroom replacement. The unit has two modes of operation, automatic or manual, separated by a mechanical interlock.

The automatic exposure system is a simple closed-loop servo utilizing a photocell density reader, a d-c amplifier and a galvanometer which actuates the light valve.

A new Houston Fearless Corp. 35/70-mm color film processor (Fig. 10) was recently installed at the Point Mugu photographic laboratory. All types of positive, negative, and reversal color film are provided for at a nominal speed of 20 ft/min of 70mm film. An advanced feature of the design is integration of all recirculation and turbulation pumps, heat exchangers and replenishment controls within the framework of the processor, allowing rapid installation in the laboratory because only solution tanks require connection at the processor. For operational control, all pump, replenishment, and machine controls are grouped on a single panel together with indicating lamps. A centrifugal pump designed primarily for corrosive photographic solutions was announced by Houston Fearless. It consists of a one-piece plastic body, a plastic impeller and a 316 stainless-steel driveshaft. A new-type rubber and carbon seal is featured. Available with either 220-v, three-phase or 120-v, single-phase $\frac{1}{3}$-hp motors, it will supply 10 gal/min at 9-lb pressure.

The M-G-M Laboratories, Inc., has used the Bell & Howell Model A Automatic Printer (Fig. 11) for color release printing for the past nine years by inserting a corrective film pack into the light beam for a given emulsion, and then modulating the light hue, subtractively and density-wise, with a traveling matte material.

This material has the hue incorporated into the film base, in density increments of 0.05 through 0.25. Such a matte material, while limiting the hue correction, necessitated the maintenance of a large inventory of matte stock. These limitations prompted the search for a more flexible method of hue print control. The mechanical solution was obtained by raising the printing machine 10 in. higher to make room for another pair of spindles. On spindles 1 and 2 (Fig. 11) is the matte containing the light density control and the single cyan and magenta density hues; on spindles 3 and 4 is the matte containing all of the yellow density hues and all of the compounding cyan and magenta hues. The double-matte system gives a greatly extended range of hue control. With the cooperation of the Eastman Kodak Motion Picture Film Dept., a system has been devised of subtracting two hues from the Eastman Color Print Film, Type 5382, thus obtaining a matte with a single hue of yellow, cyan or magenta in density increments of 0.05 through 0.5. These developments give the M-G-M Laboratories a subtractive color printer, capable of printing through any required color range of any negative.

Consolidated Film Industries has been conducting extensive tests on the Hurletron actuator coupled to a barrel type of shutter. This shutter movement allows for extremely fast light changes on high-speed printing machines. Tests are also being made on a transistorized electronic controlled vane shutter with continuous monitoring of the printing light beam. This shutter uses a nonlinear servo mechanism to provide maximum speed of response. Full-scale light changes are accomplished in 3 msec.

Also, Consolidated is now using photoflash lamps as light sources in Cinex Testers. These lamps provide light of the same intensity and color, reproducible over long periods of time. Cinex strips, prepared by using the flashlamp with its regulated voltage supply, are said to have a standard of reproducibility equivalent to strips made on a control sensitometer.

Consolidated Film Industries, Hollywood, has recognized the importance of tape-to-film transfer and established procedures for doing this work. More than 150 half-hour shows produced on

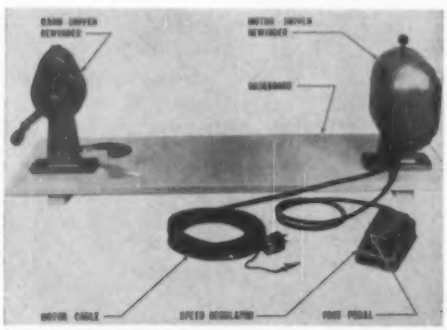

Fig. 12. Inspection unit with power rewinder and hand rewinder with elbow brake, Hollywood Film Co.

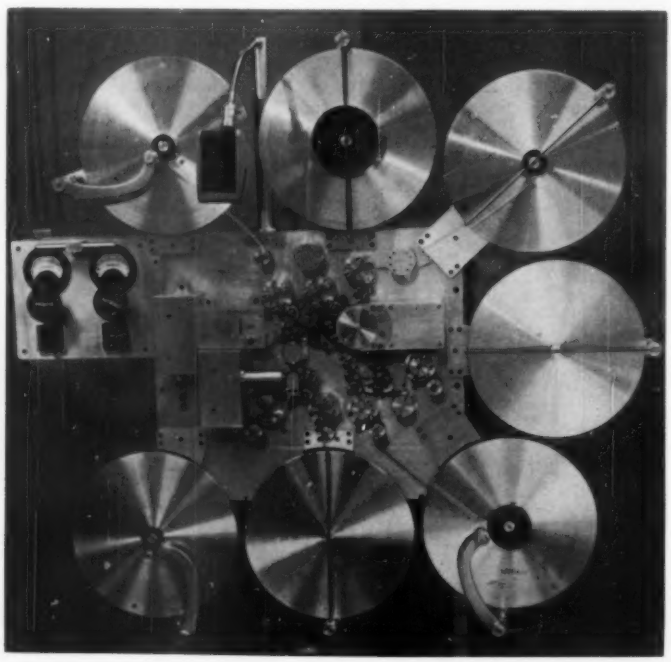

Fig. 13. JM Developments Model M-II printer.

tape have been transferred to 16mm film.

Capital Film Laboratories has reported excellent results with both the Lipsner-Smith Ultra Sonic Film Cleaner and the Unicorn Model A 5100 Motion-Picture Film Cleaner.

At General Film Laboratories in Hollywood, 16mm Kodachrome printing — A & B with scene-to-scene color, as well as density corrections—was made available last year. This equipment will also provide an Eastman Color Internegative Film, Type 7270, with the same built-in corrections. A combination 35mm and 35/32mm color negative developing machine was fabricated, installed and in November, 1959, was placed in operation. A feature of the machine is a closed-circuit drybox.

The Unicorn Solvent Cleaning Machine has completely changed the negative cleaning procedure at General Film. Three of these machines enable the laboratory to clean all its negative by machine, thus providing cleaner prints than had been achieved by previous methods.

General Film Laboratories reports that video recording facilities were set up with three 16mm and one 35mm camera chains, each providing single- or double-system sound and picture from live, tape or film original. Located at its Hollywood Laboratory, this department can also provide rapid direct positive video prints from tape or film.

Expansion was made into the Mid-West by the opening of a General Film Laboratories Kansas City Office early in the year to enable General Film to provide personal service and contact with its customers in that region.

Hollywood Film Company introduced several new pieces of equipment for laboratory use, including a 16mm hot splicer (FS-16) featuring double scraping, loss of only one-half frame on either side of splice, separate professional scraping block, left to right or right to left splicing, adjustable blades which can be set for 0.050 to 0.100 in. splice or for invisible splice used in A & B cutting, and cutter blades that can be ground or sharpened and adjusted for desired splices.

Another inspection unit consists of a new power rewind and hand rewind with elbow brake (Fig. 12). The FS-16 can be used on this unit. A hand and a power rewind with a hub to handle video-tape reels are available. A line of instrumentation and video-tape reels with NAB cores for $\frac{1}{2}$ to 2-in. magnetic film or paper tape and with flange sizes from 6 in. to 14 in. are now a stock item. Auxiliary equipment items include dispensers for table or wall mounting to store for quick release, 50-ft or 100-ft 16mm plastic reels and a 2000-ft film measuring stick for measuring color or black-and-white film on a plastic core.

Western Cine Service, early in the year, introduced the new Western Cine 8/16mm Automatic Hot Splicer. The unit features automatic emulsion removal by a rotary cutter, adjustable splice width, accurate film alignment, and uniform platen temperature.

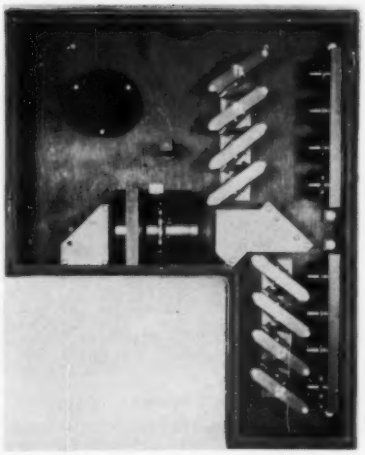

Fig. 14. Fish-Schurman multiple reduction optical system for black-and-white printing.

Technostampa, of Italy, presented a complete report on its automatic loop printing system for 35mm motion-picture film (placed in operation December 15, 1958) at the Society's 1959 Spring Convention in Miami Beach.[33a]

JM Developments, Inc., announced the new JMD Model M-II laboratory printer (Fig. 13) with facilities for magnetic-to-optical, additive color, 1-to-1 optical sound and other operation in one machine.[33b]

An automatic additive color printer with solenoid-operated vane-type shutters in the printer controlling the red, green and blue beams was developed by Bell & Howell. Dichroic mirrors split the color beams from white light; color light values and the fader-speed information are fed into the printer by a perforated tape.[34] The FS Multiple reduction optical system for black-and-white reduction printing was announced by Fish-Schurman Corp. (Fig. 14). The system is designed to produce eight 16mm images from a single 35mm negative. It consists of a long focal length lens which produces an image of the 35mm negative at infinity. This beam is split into two sections of equal illumination by means of a beam-splitting cube. Each of these beams is then split into four equal parts by three beam splitters and a first-surface mirror system.[35]

Processing Chemistry

Perhaps the most significant trend in photographic processing during 1959 has been toward simplified processing. It is apparent in scientific, engineering and industrial applications of photography that processing "on-the-spot" is becoming essential. Many of the personnel involved are not processing engineers or chemists but electronics engineers and others who use the processed photographic film or paper to provide special records or data; therefore the more simple and automatic the processing, the more widespread will be the use of photography. Convenience is paramount but, in many cases, immediate image access is an added requirement that may or may not require very rapid processing.

Motion-picture films and processes are being employed much more extensively than ever before in many scientific, technological, and business applications as well as in the production of theater feature films and TV programs. Significant improvements in processing techniques are evidenced by more compact processing machines with production rates up to 200 ft/min for release print films. The use of more efficient chemical systems has made this possible. However, despite this progress, the time from exposure to availability of the processed film is too long and frequently the photographic quality is inadequate. Therefore, "on-the-spot" processing is considered essential in many instances.

Significant improvements in the chemistry of conventional processing of both color and black-and-white films have been accomplished. Improved developer replenisher systems that function under essentially equilibrium conditions from start-up decrease chemical control and process a considerably larger volume of film or paper per unit of developer. The Kodak Durafin Developer Replenisher System for use in photofinishing is typical.

Monobath chemicals for one-step processing received considerable attention during 1959. The Cormac Chemical Corp. has reported a series of eight solutions for specific purposes to eliminate the necessity for rigid time and temperature controls. A fine-grain glycin-phenidone formula containing a small amount of soluble iodide has been used by Avco-Everett Research Laboratory to increase the emulsion speed of slow- and medium-speed films thus producing fine-grain negatives of good gradation and acutance. The Itek Corporation reported a mathematical approach to monobath kinetics.[36]

Several new processing systems designed for more rapid access of data were described. Fairchild announced a Mini-Rapid 35 unit[37] that processes 35mm film automatically at speeds up to 6 ft/min, operating under daylight conditions. Cine Speed, Inc., introduced the Instant Film Processor, a development of J. A. Maurer Co., first used for attachment to 16mm cameras used for horse race patrol.[38] Films such as Kodak Cine Tri-X Reversal and Du Pont 931A are processed, dry to dry, in 9 sec or at camera speed of 36 ft/min.

Rapid and automatic volume processing of sheet films in compact equipment

Fig. 15. Gamma radiation insensitive lenses mounted for vidicon-type cameras, Bausch & Lomb.

was accomplished with the introduction of the Kodak X-Omat Processor for medical x-ray films. An industrial version was introduced in 1959 that produces dry radiographs in 13 min, compared with more than one hour for the conventional machine process. Two smaller medical x-ray film processing units were announced: the Fisher Fax-Ray requiring seven minutes to produce a dry radiograph, and the Kodak M-3 X-Omat Processor also requiring seven minutes.

Optical Developments

Two versions of the Studio Varotal television zoom camera lens were introduced by Taylor, Taylor & Hobson. Both the vidicon form of $f/1.8$ aperture and the image-orthicon form of $f/4.5$ aperture have a zoom range of 3.55 to 1, the vidicon form being $2\frac{1}{4}$ to 8 cm and the image-orthicon form being $2\frac{1}{4}$ to 8 in. The problem of reducing wear and backlash in the moving parts to an insignificant level has been solved by the extensive use of rolling actions in place of sliding actions.[39] Zoomar introduced a 36mm to 82mm variable focus lens for Voightlander 35mm single-lens reflex cameras. At all focal lengths there is a choice of apertures from $f/2.8$ to $f/22$.[40] An 8mm D-mount camera zoom lens of 8.5mm to 25mm focal length range was introduced by Elgeet. This nine-element lens has an aperture of $f/2.5$ and is supplied with a tubular parallax correcting zoom finder.[41]

Electric Eye 8mm Zoom Cameras were announced by Kodak and Revere. The Kodak camera has an $f/1.9$ zoom lens coupled with a built-in exposure meter. The user sets the lens for 9mm (wide angle), 13mm (normal) or 24mm (telephoto), according to markings on the sleeve. The Revere Power Zoom Camera provides a pushbutton control of the Wollensak $f/1.8$ zoom lens.

Fig. 16. 40mm Ultrascope anamorphic lens mounted on Arriflex 35mm camera.

The camera also has ASA settings from 10 to 40, manual exposure control, and self-setting footage indicator.[42] A 3-to-1 focal length range $f/2.8$ zoom camera ($\frac{1}{2}$ in. to $1\frac{1}{2}$ in.) was introduced by Yashica. The camera has six speeds plus single-frame exposure.[43] Konica introduced the Konica Zoom 8 Camera. This camera exhibits a "built-around-the-lens" styling.[44] A new Pan-Cinor 10 to 30mm $f/2.8$ Varifocal zoom lens for the Camex Reflex 8 was announced by Karl Heitz, Inc. This new lens-camera combination features a large reflex image and a smooth riding lever which moves the various internal elements required to achieve the focal range and simulate dolly effects.[45]

Bausch & Lomb produced a series of six gamma radiation insensitive lenses for television pickup cameras (Fig. 15). These lenses range in focal length from 18mm to 152mm and in f/number from $f/2.5$ to 4. These lenses, because of the incorporation of special radiation-resistant glasses into their design, are not discolored by gamma radiations in "hot chamber" areas as are ordinary vidicon and image-orthicon types of lenses.[46]

A series of seven matched Schneider 16mm camera lenses was announced by Burleigh Brooks. These lenses, matched for color rendition, range from a 10mm $f/1.8$ wide-angle lens to a 150mm $f/4$ telephoto. All lenses have facilities for fade-out by completely closing the diaphragm. Both f/number and T-number scales are included as well as automatic depth of field indicators.[47] Century Photographic Equipment offered a 230-mm $f/3.8$ Tele-Athenar lens for Bell & Howell, Bolex and Cine-Kodak Special Cameras.[48] Also offered for the 16mm camera were the Astragon long-distance telephoto lenses. These 880mm $f/5.0$ and 1000mm $f/6.3$ lenses distributed by Sterling-Howard feature a 25-power optical focusing magnifier and a focusing wheel.[49]

Arriflex announced a series of Ultrascope anamorphic lenses for their 35mm

Fig. 17. Kinoptik Apochromats, color-matched (T-stop) with three-color correction for 16mm and 35mm cameras, Karl Heitz, Inc.

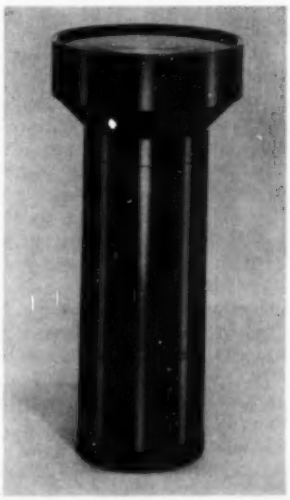

Fig. 18. Visual Image Compensator (Vicom) designed to produce a projection system of one-half the focal length of the prime lens.

camera (Fig. 16). These lenses of 50mm to 600mm focal length can be used with the normal lens turret of every standard Arriflex 35mm camera without special adapters. These lenses, which are coupled with the basic lens for single lever focus, also fit Mitchell and Newall cameras.[50] Also announced for the Arriflex 35mm camera was a specially mounted 18.5mm $f/2.2$ Angenieux wide-angle lens by Gordon Enterprises.[51]

Karl Heitz completed a series of color-matched (T-stop) Kinoptik Apochromats (Fig. 17) with three-color correction for 16mm, 35mm cine and TV cameras. The series for 16mm cameras includes twelve lenses from 5.7mm $f/1.8$ extreme wide angle up to 500mm $f/5.6$ telephoto. For 35mm cameras the series includes fifteen lenses from 25mm $f/2$ up to 500mm.[52]

For high-angle, curved-screen pro-

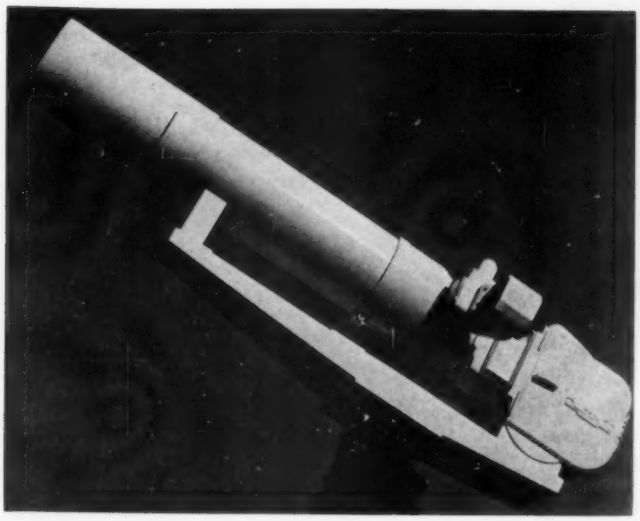

Fig. 19. Focusing version of the 40-in. Cyclotar Lens adapted by Gordon Enterprises to the Hulcher rapid-sequence camera.

jection Bausch & Lomb developed an Horizon Sag Compensation Projection System. This system as tailored to a particular theater's projection conditions reportedly can significantly improve the apparent horizon sag of the projected image as viewed from the theater auditorium.[53] The phenomenon of horizon sag is an effect of the combination of curved screen, high angle of projection and low angle of view.

Also introduced for the 35mm projection field was the Visual Image Compensator, VIC, by Vicom (Fig. 18). This adapter when attached to the prime lens of the projector produces a system of one-half the focal length of the prime lens and when used with a long-focus prime lens is said to overcome the shortcomings of poor corner illumination and edge definition frequently noted with short-focus projection lenses.[54]

A new, extreme close-up component lens for the Zeiss Ikon Contaflex III and IV cameras is now available. Fitted with a bayonet mount, the Pro-Tessar M 1:1 lens interchanges with the front element of the Tessar lens of the III and IV cameras.[55] A 35mm $f/3.5$ Schacht-Travegon internally coupled automatic wide-angle lens for the Praktica FX3 camera was introduced by the Standard Camera Corp. This new lens provides an angle of view of 62°, is of six-element construction and includes positive preselection of apertures from $f/3.5$ to $f/16$.[56]

Exakta announced a new Isco 24mm Westiogon Super Wide-Angle lens for 35mm double-frame single-lens reflex cameras. This eight-element objective renders a field of view of 82°, has six stops from $f/4$ to $f/22$ and includes half-stop settings.[57] Asahi Optical added two lenses to their Takumar series. One is a 63° retrofocus design of $f/2.3$ aperture six-element construction intended primarily for use on the Asahi Pentax camera. The other is a 105mm $f/2.8$ Auto-Takumar telephoto for the same camera.[58] A new Wirgar telephoto for the Exa camera was announced by Exakta. This 135mm $f/4.5$ lens contains four elements, focuses from five feet to infinity and stops down to $f/22$.[59]

In a novel departure a Rolleiflex with matched 135mm $f/4$ Zeiss Sonnar lenses was unveiled by Franke & Heidecke. These lenses are said to be ideal for portraiture and many other types of photography.[60] Four Zeiss lenses were designed specifically for the Linhof Super Technika IV. These lenses include a 90° wide-angle (75mm $f/4.5$ Biogon), 135mm $f/3.5$ Planar, 150mm $f/4.5$ Tessar and 250mm $f/5.6$ Sonnar.[61]

Graflex introduced a 10½-inch $f/5.6$ Rodenstock Rotelar telephoto lens mounted in the No. 1 Graphic Synchro Compur shutter for their 4 by 5 press camera.[62] A fixed-focus, as well as a focusing version of the 40-in. $f/8$ Cyclotar lens (Fig. 19) was adapted to the Hulcher rapid-sequence camera by Gordon Enterprises. Special features of this installation include a center-of-gravity balanced cradle with tripod insert.[63] A giant 38-in. $f/4$ lens, covering a 5½ by ¾-in. format, was developed by Bausch & Lomb for the New York Stock Exchange. This lens is intended to project a 14-ft ticker-tape image from a distance of 106 ft.[64]

For a single-frame background projection Buhl Optical devised a new 1-in. $f/2.8$ lens to fit the Dukane 576-39A and other projectors. This lens is characterized by a long, back-focal length, thus providing good clearance between the rear element and the film gate.[65] A high-resolution lens of 5½-in. focal length designed for photographing the face of oscilloscopes was developed by the Perkin Elmer Corp. This new lens has been corrected for the spectral output of the P-11 phosphor and has an aperture of $f/2$ (at infinity). When working at an object-to-image distance of 17.6 in. a 4½-in. diagonal format can be covered.[66]

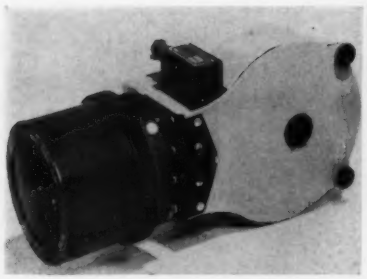

Fig. 20. Traid 730A wide-angle lens.

A new infrared transmitting material, called Irtran, was introduced by Eastman Kodak Co. The substance, which in ordinary light looks like translucent glass, retains its transparency to infrared radiations at temperatures beyond 1200 F. Irtran is said to transmit 90% radiant energy at certain wavelengths and to have improved transparency as far as 8 μ into the infrared.[67]

Enteco developed new Transpro projection filters to give slides or motion-picture films the proper color balance by either increasing or decreasing the color temperature to compensate for the needed filtering omitted during exposure.[68]

Two ultra-wide-angle lenses for 16mm cameras were announced by Traid Corp. The Traid 730A (Fig. 20) gives a field of view of 165° and a maximum aperture of $f/1.5$. The ruggedized mounting is intended for aircraft usage and includes purging ports to permit expulsion of moist air that would cause fogging at high altitudes. The Traid 120 lens also provides a coverage of 165° but is especially designed for use with the Photo-Sonics 16mm-1B rotating-prism, high-speed camera. Maximum aperture is $f/1.9$.

Zoomar introduced the Zoomar-Trulex, a device for automatic exposure control. The transmission compensation is achieved by two counter-rotating optical wedges. A beam splitter, absorbing 8% of the main light flux, works in conjunction with a computer and a built-in transistor amplifier for exposure control. This unit has a brightness range of seven stops, requires 110-v, a-c, 25-w source and is operable with a lens of 6 in. minimum focal length.[69]

An automatic profiling and semi-automatic contouring plotter was announced by Benson Lehner Corp. This instrument, the Stereomat, traces correct contour lines by means of a complex array of electronic, optical and

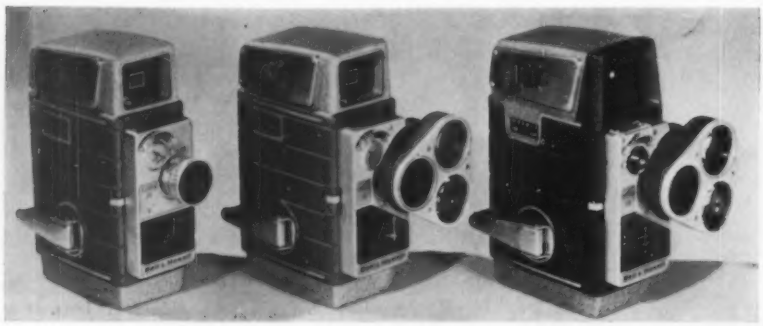

Fig. 21. Bell & Howell electric-eye movie cameras 390E, 390 TE and 393 TE.

mechanical apparatus from suitably exposed aerial negatives.[70]

A new series of spherical projection lenses was announced by Panavision. These lenses were designed specifically for the projection of 70mm film. This new series of lenses called Panavision Steinheil Pan-Quinon are manufactured by C. A. Steinheil & Son Optical Company of Munich, Germany, under an exclusive agreement with Panavision Inc. These lenses are available in focal lengths from 66mm to 7-in., and the use of high-density glass results in excellent definition and contrast with the high speed of $f/1.7$.

A new anamorphic attachment, designed and manufactured by Panavision Inc., is being used for the projection of Ultra Panavision (M-G-M Camera 65). This anamorphic attachment has a power of 1/3 and is designed specifically to cover a 70mm print.

Animation

New Oxberry stands include the Model FS-4300 for high-speed top-quality slide-film-strip production featuring autofocus and automatic rack-over. A second stand, Model MP-4200 is supplied with a 35mm camera with fixed pin registration, 47mm lens, autofocus, automatic take-up and 400-ft magazine. Also developed by Oxberry is a new optical printer (1500 series) for high-precision optical step printing and special-effects work. The 1500 will handle frame-to-frame and continuous step projection printing; freeze-frame work; in color and black-and-white. Zoom range is from 5 diameters reduction to 4 diameters enlargement.[71]

An aerial image unit designed by John Oxberry consisting of an electrically interlocked camera, projector head, lens mount, stop-motion motor, precision-ground flat-surface mirror, condenser system and all necessary controls was announced by Animation Equipment Corp. An objective lens projects the film from the shutter to form a $10\frac{1}{2}$-in. aerial image at the top surface of the field lens condensers. The objective lens of the camera records this image on the raw stock.[72]

A method of duplicating artists' original drawings was developed by Walt Disney Studios. The method is based on the Haloid Xerox Corp. Xerox process, a process based on the properties of selenium of readily accepting a static electrical charge in dim light and discharging it rapidly in bright light. Adaptation of this process enables photographic duplications of the drawings made by animation artists to be made in considerably less time than required by the older method of making numerous tracings by hand before the final print.[73]

A new process in the field of animation has been patented under the name of Technamation, making it possible to add color and motions in any direction, and at any speed or combination of directions and speeds, to any ordinary still transparency.[74]

Cameras

In 1959 there was a continuing emphasis on the production of more advanced and versatile 8mm cameras and projectors, apparently because the serious or advanced amateur is turning more and more to 8mm. Also, the use of 16mm equipment for professional and photoinstrumentation applications continued to increase due to the need for lighter weight and more compact apparatus.

Almost all of the new 8mm cameras incorporate some type of electric eye for exposure setting. A number of zoom lens 8mm cameras and battery-powered, electric motor-driven 8mm cameras were also introduced.

Roll and magazine models of Power-Zoom 8mm Eye-Matic cameras were introduced by Revere Camera Co. These feature a push-button operated automatic zoom lens which is powered by the camera's spring motor plus automatic exposure control.[75]

The Zoomatic 8mm electric-eye camera introduced by Bell & Howell features a manually operated zoom lens and instantaneous switching from normal speed to slow motion with the electric-eye system automatically compensating for the change in camera speed. This camera is said to be the first movie camera — either amateur or professional — to shift to slow motion and back again without interrupting shooting. This feature was also on the Bell & Howell Model 410 three-lens turret camera.[76]

The Kodak Zoom 8 Camera (automatic $f/1.9$) introduced by Eastman Kodak featured, in addition to a variable focal-length lens, a built-in light meter adjustable for film exposure indexes from 5 to 40.[77]

The Konica Camera Co. introduced the Konica Zoom Eight. This camera is electrically operated and features built-in exposure meter, manually operated zoom lens, and through-the-lens viewing and focusing system.[78]

DeJur-Amsco Corp. announced the Zoom Electra, a zoom 8mm movie camera with coupled viewfinder and automatic exposure control.

Karl Heitz announced the Pan-Cinor 10mm to 30mm $f/2.8$ Varifocal Zoom Lens for the Camex Reflex 8 Camera. The lens is designed for continuous through-the-lens viewing and focusing while filming.[79]

The Elgeet Zoom Lens with D-Mount varies focus from 8.5mm to 25mm and focuses from 3.3 ft to infinity.

The Nizo Helomatic Focovario 8 features a zoom lens, built-in exposure regulator, and through-the-lens viewing. Its companion camera, the Nizo Heliomatic Reflex 8, is a tri-lens cine reflex camera with built-in exposure regulator. These cameras also feature a back-winding and frame-counting mechanism as well as an automatic stop at the end of the film.

Keystone announced three new 8mm fully automatic electric-eye cameras, two for roll film and one for magazines.[80]

The Yashica 8mm 8 ES three-lens turret movie camera has a wind-back system which allows lap dissolves, fades, and double exposures. The Yashica Zoom 8mm Camera, the 8 EC, has a zooming range from 13mm to 38mm.[81] Paillard, Inc., introduced a new compumatic 8mm camera, the Bolex D 8L, with three-lens turret.[82]

The Baskon Corp. announced their first camera, an 8mm electric-eye battery-powered camera, called the Baskon Electric Eight.[83]

Two 8mm cameras were introduced by Argus Division of Sylvania Electric Products Inc.: the Cinetronic M-3 with electric-eye exposure control and the Match-Matic with an attached LM three-exposure meter.[84]

For the advanced amateur the Emel Plume 8mm camera was announced by Akarex Corp. It features rewind key for double exposure, individual frame counter, and parallax correction to 10 in.[85]

Bell & Howell, in anticipation of new, faster color films, modified its

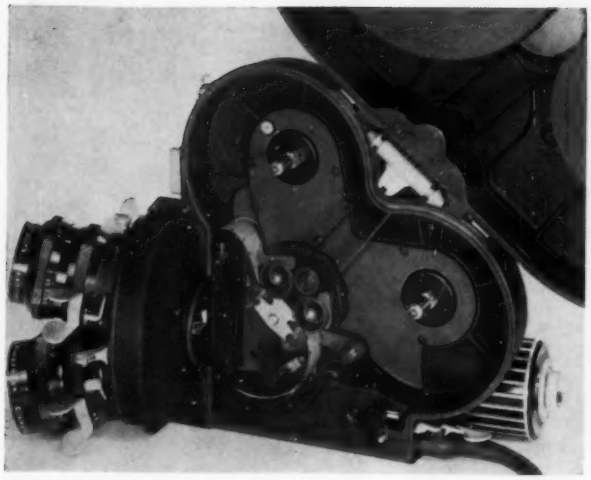

Fig. 22. Interior view of Arriflex 16 with new buckle switch, film guide and spindle-drive cover. New cable lock is shown at back of the camera.

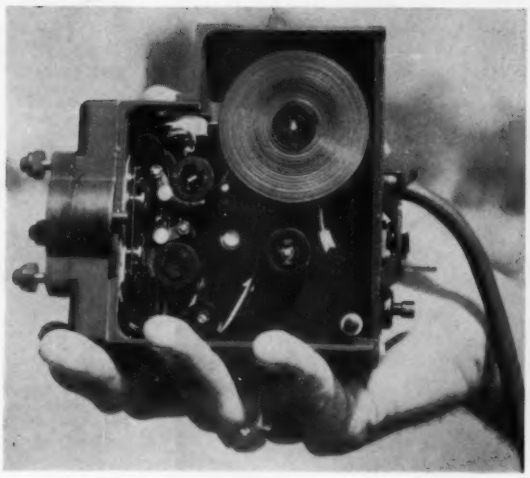

Fig. 23. Traid 15 miniature 16mm camera.

full line of 8mm electric-eye movie cameras (Fig. 21) to accept wide range of films.

A 16mm camera with a self-contained magnetic sound system was announced by Fairchild Camera and Instrument Corp. Called the Cinephonic, the camera is designed for maximum portability and has a built-in miniature, transistorized magnetic sound recorder.[86]

Houston-Fearless introduced the Camerette Double-System Sound Camera which uses either 16mm or 35mm film as well as 16mm or 35mm fully coated magnetic sound film.[87]

Paillard, Inc., announced the Bolex H-16 Rex Reflex, a three-lens turret reflex camera with variable shutter, featuring the "Rexofader."[88]

Arriflex Corp. of America in 1959 added to the current Arriflex-16 camera new features including buckle switch, new and improved sprocket film-guide and power cable retaining lock, among others (Fig. 22).

Arriflex Corp. also introduced its ultra-compact system for synchronous sound recording. The system is based on an Arriflex 16 equipped with a control signal generator geared to the camera drive movement and a self-contained, self-powered tape recorder.

The Arriflex 35, II BV, first became available early in 1959. This model features a calibrated variable shutter which may be adjusted from 0° to 180° max, in 15° increments.

The Traid Model 805 Fototracer, a 16mm camera which holds 1200 ft of film for filming events up to 50-min duration, was announced by Traid Corporation.[89]

The Traid 15, a miniature 16mm magazine-type camera (Fig. 23), designed especially for missile and aircraft applications, was also developed by Traid Corp. The camera is equipped with variable shutter and has double-tooth sprockets for high "G" loading.[90]

Flight Research announced two new 16mm film magazines designed to "throw" film to the camera on demand. They are constructed for use with their Model III and III-B Multidata cameras and have film capacities of 200 ft and 800 ft.[91]

Flight Research also announced a variable shutter for the Model IV-C Multidata camera which allows the opening to be adjusted from 0° to 130° in 2.5° gradations.[92]

The model IV-E 35mm Multidata recording camera, which uses split optics to record auxiliary information directly onto the film, was announced by Flight Research, Inc.[93]

The Digital Recorder was developed by Magnavox Research Labs for use on the 35mm Traid Fototracker Camera and on the Bell & Howell Model 71 Eyemo cameras and was introduced by Traid Corp. This device provides a 96-bit matrix image on each frame.[94]

Birns & Sawyer announced an underwater blimp for the Arriflex 16mm or 35mm cameras which is said to have undergone extensive tests at depths to 300 ft.[95]

An underwater housing for the Kodak K-100 16mm camera capable of withstanding water pressure at depths down to 175 ft was introduced by Camera Equipment Company.[96]

A single-frame camera motor to operate any type of 16mm or 35mm camera having a single-frame crank was announced by Rolab Photo-Science Labs.[97]

Camera Equipment Co. announced a Stop Motion Motor for the Cine-Kodak Special, and Traid Corporation developed the Traid 72 Motor Kit for Bell & Howell 70 cameras, which is designed to provide continuous or burst operation overruns of 400 ft or more.[98]

Two new tripod heads were introduced during the year by Camera Equipment Corp. — the CECO Pro Jr. fluid head which uses a highly molecular silicone polymer and the vidicon pan and tilt head which has a built-in balance feature that counterbalances the weight of the camera.[99]

A new Mitchell BFC, 65mm camera, was introduced. Lenses for this camera were selected from quality $2\frac{1}{4}$ by $2\frac{1}{4}$ still cameras and include 35mm, 53mm and 58mm wide-angle lenses, 75mm normal and 100mm and 150mm long-focus lenses.[100] A portable electric 35mm Newman-Sinclair Kine camera was announced by James A. Sinclair & Co., Ltd. Overall dimensions of the camera, designed to be as small and light in weight as possible, are: height, 7 in.; width, 7 in.; length, 9 in.; and weight, $6\frac{1}{2}$ lb including tachometer and footage indicator.[101]

An improved Exakta $2\frac{1}{4}$ by $2\frac{1}{4}$ camera with a Zeiss 80mm $f/2.8$ Tessar was introduced. The camera, Exakta 66, has a two-curtain cloth shutter and provides 29 speeds from 12 sec to 1/1000 sec exposure.[102] The Graphic 35 Electric camera features a motor drive powered by two Penlite cells. This camera, announced by Graflex, incorporates interchangeable lenses and is available with either an $f/1.9$ or an $f/2.8$ normal lens.[103]

Projectors

In projectors as well as cameras the majority of the new developments during 1959 were in 8mm. A number of self-threading projectors made their appearance during the year and higher screen illumination was obtained through the use of new low-voltage lamps with internal reflectors. Several imported 8mm sound projectors made their appearance and seemed to be quite successful.

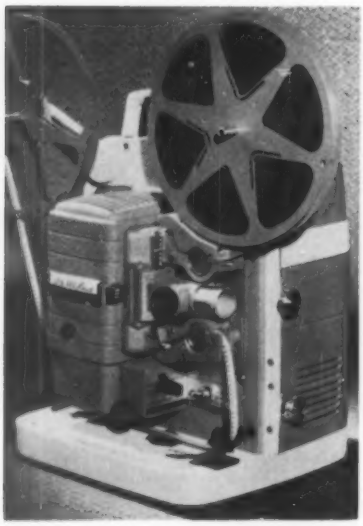

Fig. 24. Super Auto Load automatic self-threading 8mm projector, Bell & Howell.

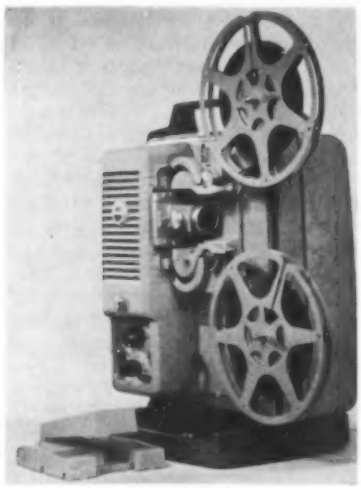

Fig. 25. Model A-30 Showtime projector with splicer, Eastman Kodak.

Bell & Howell introduced two new automatic self-threading 8mm projectors using the new Sylvania low-voltage Tru-Flector projection lamps. The Lumina 1.2, claimed to be the brightest 8mm projector available, uses an $f/1.2$ lens in conjunction with the new horizontal burning T-14 Super Tru-Flector lamp. Its companion projector, the Super Auto Load (Fig. 24) uses an $f/1.6$ lens and the new Sylvania T-12 Super Tru-Flector lamp. A special transformer supplying low voltage to the new lamps is said to provide more screen illumination at 155 w than the standard 500-w lamps. Both are available with zoom projection lenses.[104]

Eastman Kodak also introduced 8mm projectors incorporating a new type of projection lamp. The self-threading Kodak Cine Kodak Showtime projectors,

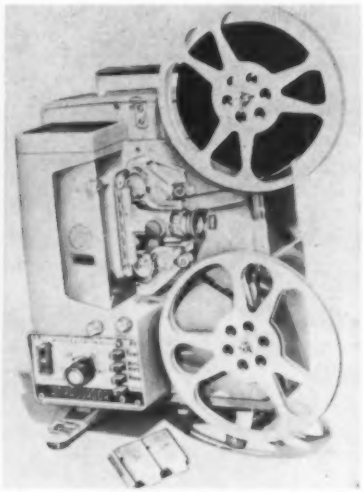

Fig. 26. DeJur-Amsco Ambassador Auto-Load 8mm projector with zoom lens.

Models A-30 (Fig. 25) and A-20, use a new General Electric 500-w T-12 lamp with a unique, nonaxial glass reflector. Also introduced was the budget-priced Brownie 8 projector, Model 10, which is as compact as a small portable radio. It uses a new GE lamp which incorporates a built-in reflector outside the envelope, and offers the ease of sprocketless loading.[105]

The Ambassador Auto-Load projector (Fig. 26) is a new self-threading projector with zoom lens, announced by DeJur-Amsco Corp.

The Keystone K-110 Deluxe 8mm projector (Fig. 27), using the Super Tru-Flector 10-v lamp, features a motor-driven action editor and pushbutton controls.

An 8mm projector, the M 750, introduced by Argus of Sylvania Electric Products, Inc., has a variable focal-length lens and uses the Super Tru-Flector projection lamp.[106]

The Nizo Cinemator (Fig. 28) Type 2 8mm sound projector also uses 8mm magnetic-striped film.

The Elite 8, an 8mm sound projector of Norwegian manufacture, which provides for recording on magnetic-striped film, was announced by Tandberg of America, Inc.[107]

A standardized 16mm JAN sound projector was established by the Projection Equipment Committee under Standardization Working Group 402-40E of F.S.C. Group 67. The transition from three different projectors used by the Army, Navy and Air Force to a single projector was accompanied by design improvements for the new projector. The projector was described in a paper presented at the Society's Spring Convention in Miami Beach.[108]

The Teclite, a lightweight (less than 30 lb) 16mm projector was announced by Technical Service Inc. The single-case unit contains a newly designed 15-w,

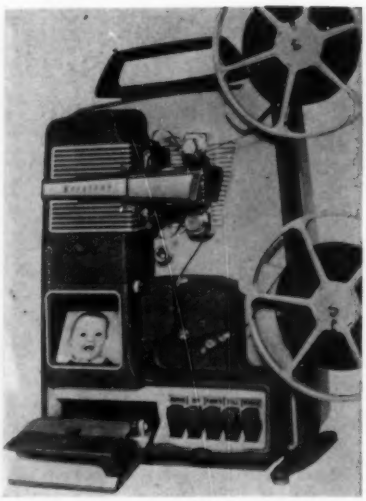

Fig. 27. Keystone K-110 8mm projector with editor, pushbutton controls and splicer.

Fig. 28. Nizo Cinemator 8mm magnetic sound projector.

a-c/d-c amplifier and a detachable 8-in. speaker.[109]

Kodak announced for the Pageant projector a miniature solar cell to replace the conventional phototube. This is said to improve signal-to-noise ratio, eliminate some optics, and give lower amplifier input impedance. Victor Kalart came out with an improved version of the Victor 16mm sound projector. Kodak, in March 1960, showed a new 8mm sound on magnetic film recorder-projector called the Kodak-Sound-8. A 35mm projector, Model 2810PL3, has been added to the DeVry line. Designed for simultaneous projection of 35mm picture work print and separate 35mm sound optical work print it is recommended as a preview model for TV film programs.[110]

An opaque projector capable of producing intricate and elaborate effects has been described. Emphasis in the

design of this equipment, developed by Radio Tokyo, JOKR-TV, is on simplicity of operation.[111] A Military 16mm Assaying Projector has been designed by Bell & Howell. This projector includes local and remote control of 360° rotation of projected image, focusing, framing, forward and reverse and single-frame projection.[112]

National Carbon unveiled a new 9mm high-intensity positive projector carbon. Amperage for the new carbon has been increased from the previous 75 to 85 amperage range to a top of 90 amp to make possible 10% more light at the same burning rate.[113] Bell & Howell introduced an 8mm projector with a new Sylvania reflector-type projection lamp affording a projection system speed of $f/1.2$.[114]

Zeiss Ikon announced an automatic projector system using special switches to trigger the various operations of a motion-picture program automatically. Each step, from the lowering of the house lights and the raising of the curtain, to the close of the final film, can be preset.[115]

Wide-Screen and New Processes

During 1959 no new generally accepted process in wide-screen was developed, although one new process, called Variascope, was announced early in the year.[116] There were many notices of 70mm projector installations, world-wide, and most companies were using CinemaScope (or some variation of it), Technirama, or 65mm, or 70mm. Paramount announced it would use the Technirama anamorphic process.[117]

Several related items will be found under the heading "Optical Developments" earlier in this Report.

The first motion picture photographed in Ultra Panavision (M-G-M Camera 65) released in 70mm is *Ben Hur*. The system photographs on 65mm film and projects a 70mm contact print carrying six magnetic soundtracks. Special Panavision camera lenses designed for this system have an anamorphic squeeze ratio of one-third which creates a slightly anamorphosed image on the 65mm negative. If the ensuing print from this negative is projected without magnetic sound striping on the release print an aspect ratio of 3:1 is available. With six magnetic tracks applied directly to the release print the maximum aspect ratio is 2.7:1. The first use of Panavision 70 was for the production, *The Big Fisherman*. This system is similar to Ultra Panavision except that spherical lenses are used instead of anamorphic.

A new projection process known as CinemaGraf was announced. The first film to be made in this process is to be a religious film. It is described as achieving the effect of 3-D without glasses and employs wide screen, color and stereophonic sound.[118]

Another new process called Cinemagic optically and chemically changes the photographic image to make it appear similar to drawings that move. The first show to use the process was *Invasion of Mars*.[119]

Two new processes designed to enhance the enjoyment of motion-picture viewing by releasing appropriate scents to heighten the effectiveness of the drama were introduced during the year. A process called Aromarama was used for the production *Behind the Great Wall* which received a number of favorable reviews.[120] Another process called Smell-O-Vision was introduced with the motion-picture, *Scent of Mystery*, produced by Mike Todd, Jr., and Elizabeth Taylor. The machine used to dispense the various odors is a product of the Belock Instrument Co. The apparatus is automatically cued by one of eight soundtracks to dispense the appropriate odor to each seat in the theater.[121a]

A filming process called Perceptovision, said to be a combination of split screen and traveling matte process, was developed by Bert I. Gordon, a producer-director, and used by him in his film *The Boy and the Pirates*.[121b]

Drive-In Theaters

A theater called the Motocine was recently opened in Madrid, Spain. Bilingual equipment permits selection of either the Spanish dubbed version or the original, which is usually in English. Because a large number of motorcycles and scooters are used in Spain, a special parking space has been provided at the rear of the car ramps with a seating space for 700 people. A miniature drive-in is called the Motocineta. Instead of conventional seats it has small cars where children may watch cartoons and short subjects on 16mm equipment while their parents watch dramas that Spanish censorship forbids children to see.

The Motocine has space for 772 cars. The total land area is one million sq ft. The ramps occupy 360,000 sq ft. The projection throw is 330 ft and the screen measures 48 by 102 ft. Equipment was installed by Westrex Corporation Iberica and includes two Westar projectors, two Ashcraft super power arc lamps, and two separate photo/magnetic soundheads with pedestal and magazines for the original version which may be either magnetic or photographic. A five-bay rack includes nine 100-w amplifiers of which four are normally used for the Spanish version and two for the original version.

The Ciudad Satellite Drive-In Theatre opened in Mexico City. Said to be the most modern installation of its kind in Mexico City, it has space for 750 cars and maintains restaurant and cafeteria service.[122]

Scheduled for opening in 1959 was the Drigh Road Drive-In Cinema in Karachi, Pakistan. Located on a seven-acre tract, most of the equipment is supplied by S.O.S. Cinema Supply Corp.[123]

The Metro Gateshead Drive-In is located within eight miles of the steel city of Newcastle, Australia. There is space on the lot for 700 cars. The curved screen measures 115 ft by 50 ft; constructed of fibro cement sheeting attached to timber and mounted on steel towering, the whole screen structure is designed to withstand winds up to 120 mph. Sound and projection equipment was installed by Westrex Australia.[124]

The second half of the Tu-Vu Drive-In Theatre, San Diego, Calif., was opened during the year. This drive-in is equipped with two screens, each 45 ft by 90 ft, located at angles from the projection room which is at the center front of the lot. The projection room houses two sets of equipment. Two feature films are shown simultaneously and then transposed between projection equipment so that each audience can see a complete show or can have a choice of films.[125]

Nontheatrical Films

Economically, the 16mm field made excellent progress in 1959, the best in several years. One important event was the introduction of a new 16mm color film. One encouraging sign is the continuing expansion of instructional materials centers in schools, keeping pace with the increasing use of films and other audio-visual material as an integral part of the overall educational program. The establishment of materials centers in various schools simplifies distribution and provides teachers with ready access to appropriate films or other materials.

Following the slow year of 1958, sales of nontheatrical film made a 12% gain in 1959. In round figures, the total of $287 million shows a gain of $32 million over the 1958 total of $255 million. This is almost twice the rate of gain of the national income. Earlier this year a report presented data in tabular form bringing up to date comparative information about who buys or sponsors nontheatrical films, on what the money is spent and the number of films by types.[126] This was the latest of several reports in recent years.

From a production standpoint, faster and improved film emulsions brought about an increase in so-called low-cost productions. In both medicine and industry the number of motion pictures gained dramatically over 1958.

A significant development in the 16mm field was the introduction of a new 16mm color film — Commercial Ektachrome — by the Eastman Kodak Company. In Europe especially, the door has now been opened to extensive use of color in 16mm, heretofore quite negligible. Improved high-speed color films have also broadened production possi-

bilities, allowing shooting in places inaccessible to lights.

Film festivals were an important activity domestically as well as in all parts of the world. The American Film Festival, held in New York City, recognized 35 motion pictures for their excellence. CINE (Committee for International Nontheatrical Events) helped coordinate American films entered in three European festivals: the Industrial Film Festival at Harrogate, England; The Edinburgh Film Festival; and the Venice Film Festival.

Education

"The ultimate goal of the Houston (Texas) audio-visual program is to establish an instructional materials center in each school building. This is an expanded concept of libraries wherein the library and audio-visual programs are coordinated, and is to be implemented by broadening library duties to include instructional resources (motion pictures, filmstrips, 2 by 2-in. slides, etc.) other than books," wrote A-V librarian, Mrs. Kathryn Thompson.[127a]

Such centers will place motion pictures and other teaching tools closer to the ultimate user — the teacher. These instructional materials centers include production facilities which allow individual teachers to produce their own simple materials.

At Southern Illinois University, Dr. Paul R. Wendt and Dr. Gordon Keith Butts announced the results of a research project supported by Coronet Films wherein high-school classes in World History, using 54 motion pictures, completed the traditional two-semester course in one semester. The students in the seven experimental classes were on a par with seven control classes. Tests at the end of the course indicated that the achievement of the one-semester classes (using films) was comparable to that of the two-semester classes, using the lecture, reading, and occasional film method.

The findings of this project can have great significance for educators who already need more class time for the teaching of science courses and other difficult curriculum subjects. By freeing time as courses are shortened, the competition for class hours may be lessened.

It is too early to determine the full impact on education of the National Defense Education Act. Toward the end of 1959, there were indications that the increased use of visuals by schools, including motion pictures, was taking hold. On the other hand, many state programs are not yet operating effectively. Research projects under Title VII are gaining momentum, but have not produced any startling results to date. Also, in educational television, no dramatic outcome is evident, although installations are increasing and are second in dollar volume to language laboratory installations.

Interest in motion pictures by scientists and science teachers led to the formation of the American Science Film Association. In September, at Woods Hole, Mass., a conference of scientists paid special attention to the role of the motion picture in teaching science. This increased prestige of films is expected to have a profound effect in coming years.

A direct product of the Audio-Visual Council on Public Information, working with the U.S. Office of Education under NDEA, is the book, *Budgeting for Your Audio-Visual Program* by the late Dr. K. C. Rugg of Indiana University. It is significant that the study, in highlighting 28 typically successful programs of school systems of different sizes and locales, brings out the fact that all across the country, audio-visual communication has become an accepted technique of classroom teaching.

Educators reported that classroom films are improving in quality. One audio-visual director stated, "The innovations that independent producers, including university producers, have made toward devising more imaginative production practices are a real contribution. The movement away from hackneyed, stereotyped approaches is heartening."

In a talk given before the University Film Producers Association, a film industry leader, Lloyd Thompson, predicted that within a few years, 8mm magnetic sound film may become the dominant gauge, just as 16mm film is today. The UFPA, which is thirteen years old, is striving to step up the training of future film-makers in order to fill an increased demand for creative and technically competent production personnel. More than 80 universities now have on-campus film production units to turn out alumni, fund-raising, public relations films and educational pictures for college-level use dealing with those topics which are not feasible or profitable for commercial educational production. At certain institutions, this production activity assists students in learning the art of motion-picture making.

Two student productions from the University of Southern California caught attention: *American Bazaar* (a supermarket as seen through the eyes of an Iranian) and *Have I Told You Lately That I Love You* (a satire on modern living with all the electric appliances in the home).

An educational producer, Horizons of Science, in cooperation with the Educational Testing Service, Inc., is producing a series of unusual science films. One of these is *The World of Dr. Vishniac.* Encyclopaedia Britannica's chemistry series is completed, and schools now have a complete year-long curriculum available on film. McGraw-Hill released a biology series of 120 films and Massachusetts Institute of Technology is producing 70 films on physics.

The University of Miami (Florida) produced a series of 12 half-hour color motion pictures on marine life.[127b] This $60,000 project is called *Survival in the Sea.*

Said by many educators to be one of the finest teaching series yet made, 90 humanities films were begun on a $1,110,000 grant from the Ford Foundation. Independently produced in Boston and distributed by Encyclopaedia Britannica Films, the grant was terminated after the completion of 12 titles on drama. Other subjects were to have been music, painting, architecture, sculpture and poetry.

Business and Industry

Business firms continued as leading users of visual communications. Two large automobile manufacturers alone budgeted over $18 million, which is more than half the total spent in 1959 for all audio-visuals in America's schools.

A notable development in industry is the expanding use of "low-cost" motion pictures. Film laboratories reported, in some cases, a 100% increase in this type of film produced within business concerns by their own personnel. This can be attributed to better cameras, improved motion-picture film emulsions, and the magnetic-striped soundtrack and projector.

Adopting the production speed of the newsreels, Douglas Aircraft is turning out regularly a 20-minute color sync sound report of a Cape Canaveral Thor test firing which is ready for screening in California 72 hours after the event. These are called "quick-look" films.

Considered by many to be the outstanding film of 1959 for the entire nontheatrical field was Pan American World Airways' *Speaking of Words*, an imaginative picture on the problems of communications between people. Southern Bell Telephone's *Dial the Miles* gives a clear and simple explanation of long-distance dialing in the United States.

As competition has intensified, the trend in the business field has been toward more selling, sales promotion and sales training films. Increasingly, companies are furnishing their salesmen with projectors in order to use the motion picture as a direct-sales tool. It has been predicted that 8mm sound projectors will be important in selling programs.

Also in 1959 more well-done labor union films were produced. Noteworthy was the Rubber Workers' *A Mighty Fine Union.*

Esso Standard Oil is presenting a timely social message in its film on Puerto Rico, *Beyond the Valley*, a tasteful, well-photographed documentary giving the rest of America a wholly different

and constructive viewpoint on the Puerto Rican people themselves, rather than the one-sided juvenile delinquency slant so often played up in newspaper headlines.

Increased business activity abroad has brought an increase in the exporting of U.S. films. Movies, U.S.A., a commercial film distributor, announced the establishment of an international department.

Department of Commerce figures and U.S. Information Agency reports both indicate increased overseas 16mm activity. The exporting of 16mm prints has increased more than thirteen times since 1941:

1941: $ 207,289
1959: $2,800,000 (estimated)

During the past decade, the U.S. Information Agency has issued 14,645 certificates which certify that an audio-visual item is educational, cultural, or scientific in nature and should enter a country without customs duty.

Motion pictures	9094
Recordings	2100
Filmstrips	2492
Slides	565
Maps, charts, posters	341
Special Certificates	53
	14,645

In 1959, 886 motion-picture certificates were issued, which was 18% more than the 749 issued in 1958.

Trade and professional associations accounted for several exceptional films. The National Cotton Council's *Cotton: Nature's Wonder Fiber* won applause for its production qualities. The National Association of Investment Companies' *The Hope That Jack Built* utilizes interesting animation effectively.

Civic, Social Welfare and Recreational Organizations

Money spent for circulation of non-theatrical motion pictures was up 12% in 1959. The American Library Association reported that film audiences served by public book libraries were up in 1958 by 11%. The number of public libraries circulating films also increased, as did the number of regional film circuits and central pools (see accompanying tabulation).

Public Library Film Activities

	1957	*1958*
Public Libraries with basic Film Collections	66	69
Regional Film Circuits or Central Pools	20	23
Audience Attendance	32,600,000	36,100,000
% Increase Over Previous Year	18%	11%
Total A-V Budgets and Print Costs (Estimated)	$545,831	$585,683*

* Only 61 libraries reported their spending for 1958.

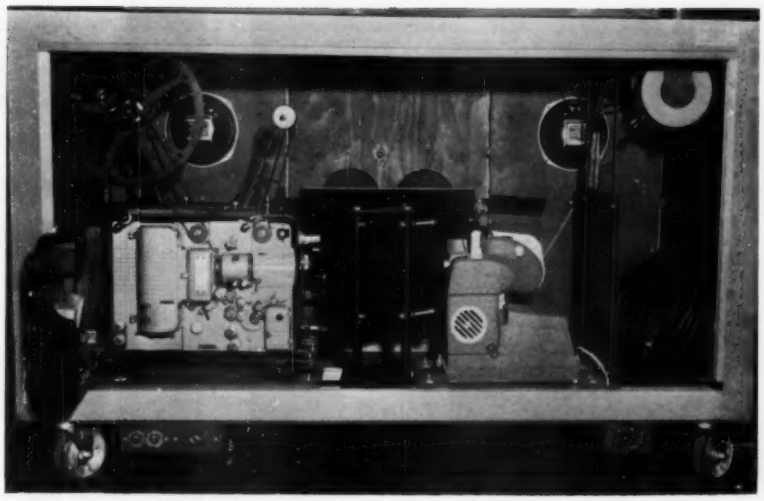

Fig. 29. Teaching machine developed at Army Engineer School, Fort Belvoir, Va., incorporates moving and still images in a single unit.

Other sources such as commercial film distributors, business firms, medical film libraries, and educational film libraries reported 1959 circulation increases anywhere from 10% to 25%. This upward trend was borne out by the market increase in release print dollar figures.

The Library of Congress now has been publishing catalog cards for motion pictures and filmstrips since 1951. Cards for 35,000 titles have now been printed. The number of producers sending in film data for cataloging increased from 700 to 950 during the year. A total of 575 subscribers are regular purchasers of cards for films in their own collections, while 19 have cards for the entire 35,000 titles.

Religious

Emphasis during 1959 by religious audio-visual leaders was on greater utilization of religious films. Local churches and synagogues were given greater assistance in integrating films and filmstrips in religious education classes. In the past 45 years, over 2400 films have been produced expressly for religious use. Filmstrips and slide sets probably exceed that total figure.

Religious film production was up. Different in content from the traditional type of religious film was *Make It Work*, produced by the Seventh Day Adventists. This unusual picture shows church people how to handle publicity.

Government

At the U.S. exhibition in Moscow during the summer, a new technique called Septorama combining motion pictures and slides drew wide attention. Using seven 35mm motion pictures run in synchronization, over 2000 slides printed on motion-picture film were screened in twelve minutes.

The U.S. Information Agency film program has been helping to carry the American story to other nations around the world. Because the USIS scope of operations begins outside the borders of this country, few U.S. citizens are fully aware of its magnitude. The cultural exchange agreement with the Russian government did receive wide notice in the U.S. press. Unheralded have been the day-in-and-day-out efforts of USIA officials to assist American film producers and sponsors in finding wider use for their films in the export market. A second major catalog of films available to overseas audiences, "United States Educational, Scientific and Cultural Motion Pictures and Filmstrips, Educational and Productivity Section: 1958" was published in 1959. These catalogs are available in all USIS libraries around the world.

The age of rockets and satellites inspired a number of films. Outstanding are the Air Force's *Atlas: The ICBM*, the Army's *Explorer I*, and the Navy's *Operation Sunshine*, telling the story of the Nautilus' trip under the Arctic Ocean. Walt Disney released two more popularized films in this area, *Mars and Beyond* and *Man and the Moon*.

During 1959, language laboratories (for teaching modern foreign languages primarily by using tape recorders) and teaching machines have aroused a great deal of interest. Probably the most ambitious of the many approaches to the teaching machine is the unit developed by the U.S. Army Engineer School at Fort Belvoir, Va., which incorporates both moving and still images in a single unit (Fig. 29). Integrated in it are a 16mm motion-picture projector, 35mm filmstrip, 2 by 2-in. slide projector, and an overhead transparency projector as a mobile unit utilizing rear-projection technique.

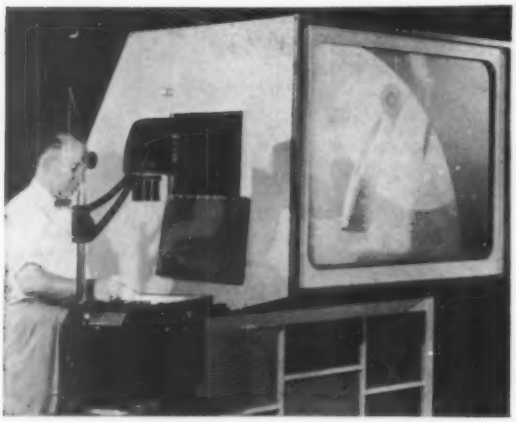

Fig. 30. Remote controls of the teaching machine provide flexibility with a minimum of interruptions.

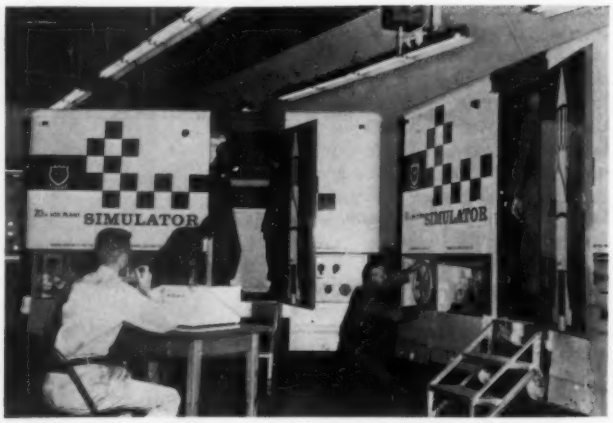

Fig. 31. The teaching machines replace the $1½ million LOX generating plant. The instructor remotely activates the filmstrip presenting in sequence 194 problem situations. The student's response is in terms of physical manipulation of plant controls.

This unit was designed to encompass many features. Ambient light viewing is possible, thus avoiding the problem of darkening classrooms, which is expensive and also curtails easy note-taking by students. Many forms of image projection can be accomplished with one machine. Remote controls give the instructor flexible and complete control to start and stop the visuals with little interruption to the class, avoiding wasted time and the distraction of setting up or changing equipment during a class (Fig. 30).

The unit is mobile and therefore can be moved to any desired classroom instead of moving classes to special rooms where all of this equipment might otherwise be available. Because it is designed as a single unit (similar to a large television set), student attention can easily be focused in one direction at an accepted "household communicator" (the standard television set).

Of significance is the fact that previously the Fort Belvoir school was short nine classrooms. The use of this new unit has eliminated that shortage and in addition has increased the instructor hours by 50,000. The school has had a student load over the past three years of 10,000 to 12,000 persons per year. In one situation, the new teaching machine replaces a $1.5 million LOX generating plant, doing it with less noise, more safety, and much quicker (Fig. 31).

Instrumentation and High-Speed Photography

All other accomplishments in the field of optical instrumentation during 1959 were overshadowed by the very considerable technical feat performed by Russia in recording and retrieving a picture of the moon's far side,[128] a dramatic illustration of the great achievements in this field of science and technology predicted for the decade now beginning. It is appropriate that in the first year of this decade, the Fifth International Congress on High-Speed Photography will be held in Washington, D.C., October 17–21, 1960.

New tools for the worker in high-speed photography appeared in abundance during the year, ranging from laboratory devices weighing about a ton to missile cameras small enough to be held in one hand. The Model 192 Beckman & Whitley Framing Camera weighs 1,800 lb, takes 82 pictures 17 by 25 mm in size at rates up to 1,400,000/sec, with a writing timing of 55 μsec and an exposure time of 0.1 μsec. It is capable of operation without synchronization with the subject being studied, and employs a blast shutter to prevent rewrite.[129] In the 170-pound class, the Photo-Sonics 70mm-10B[130] camera (Fig. 32) adapts for the first time the principle of the high-speed rotating-prism camera to 70mm film, giving 360 full-frame (2¼ by 2¼-in.) pictures/sec. A rotating disc shutter is also incorporated behind the prism for further resolution and motion-stopping capability.

At the other end of the size scale is the Traid 15 missile camera, a mere handful weighing less than three pounds with its 50 ft load of 16mm film (see Cameras section above). In between are such instruments as the 35mm cameras produced by Pacific Laboratories and Optomechanisms[131] and the new Waddell 16mm high-speed rotating prism camera.

Development of a long-duration photoflash bulb by Sylvania has been described by Fink,[132] while Wilson[133] outlined details of a new series of Westinghouse 300-w photoflood lamps for high-speed photography. In an extension of his excellent paper "Color Exposure for High-Speed Photography of Some Self-Luminous Events," published in the *Journal* in 1958, Lohse[134] has examined the techniques of utilizing artificial illumination in high-speed photography.

Extremely interesting developments in the field of image converter tubes were outlined by Reed and Niklas[135] in a paper which indicated progress comparable to that made in Great Britain, where such work has been pursued intensively for a number of years. Sixteen exposures have been obtained, with a light flux density gain of 48, and an

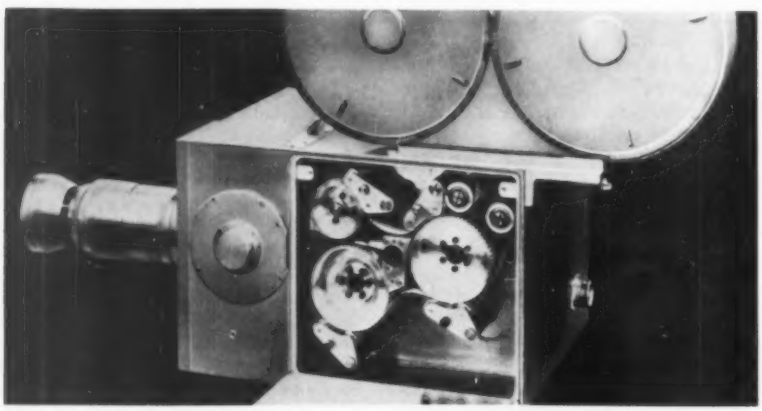

Fig. 32. Photo-Sonics 70mm-10B camera.

exposure time per frame in the range of 10^{-6} to 10^{-9} sec. Avco has developed a rotating-mirror and a rotating-drum camera now commercially available. Both cameras utilize compressed air-driven turbines — the rotating mirror camera provides a writing speed of 4mm/μsec — the rotating drum has a writing speed of 0.18mm/μsec. Avco has also developed a Kerr Cell shutter giving exposures as short as 0.01 μsec.

Utilization of a magnetooptic shutter with an exposure time of one μsec in conjunction with other capping shutters to photograph early stages of an atomic explosion was described in a most interesting paper by Edgerton.[136] It should be noted that Dr. Harold E. Edgerton was honored by this Society during 1959 by award of the Progress Medal — the Society's highest award.

Other applications of high-speed photography were given by Krenzel,[137] who discussed methods used to record shockwaves produced by supersonic rocket sleds; Hall,[138] who has obtained velocity measurements from film records of projectiles traveling at more than 15,000 ft/sec; Hall and Bailey[139] cover event initiation and camera shutoff (to the point that it may be possible to run 10 ft of sensitized film and 90 ft of leader in a 100-ft roll!); and Endelman,[140] who outlined some of the field problems encountered in metric photo operations at Cape Canaveral.

It was appropriate that the 87th Convention of the Society, held at Miami Beach during May, 1959, should have been addressed by Major General John B. Medaris, then Commanding General, Army's Ordnance Command. General Medaris spoke on "The SMPTE, The Army, Missiles, and Space Vehicles." His complete address[141] should be studied as a guide to the manner in which this Society can contribute to these vital programs in the decade now underway.

The Armed Forces

An improved model of the Log-Etronic Strip Printer, commercially designated as Model SP10/70, was designed and fabricated for the U.S. Navy by LogEtronics, Inc., Alexandria, Va., in accordance with Bureau of Aeronautics development specifications. Five printers have been delivered for service tests. The LogEtronic Strip Printer is designed to print, in roll form, from any transparency (either negative or positive) on to any photosensitive material available in roll form and having an emulsion speed equivalent to that of enlarging paper. The unique feature of the SP10/70 is its ability to control automatically the exposure of the photosensitive material as it passes continuously through the printing stage. For a given printing material exposure will be uniform from frame to frame, and within each frame, regardless of the non-uniformities present in the transparency. These results are achieved by using a cathode-ray tube for the scanning light source in conjunction with inverse feedback from a pair of photomultiplier tubes.

A closed-circuit television camera and associated equipment was developed by General Precision Laboratory Inc. and produced for the U.S. Navy Bureau of Ships, packaged to special military requirements. Operating on a Navy standard of 875 lines, it provides horizontal picture resolution of 1000 lines to permit the transmission and viewing of documentary information previously considered impossible or impractical.

Early in 1959, the educational television system of the U.S. Army Signal School, Fort Monmouth, N.J., was placed in operation. Described as the "world's largest," this greatly expanded system employs RCA cameras and associated studio equipment and 468 receivers to bring instruction courses and training material to a student body of (at that time) 6000 men. The main studio measures 40 by 50 ft with overhead clearance of 15 ft. The walls and ceiling are lined with glass fiber acoustical insulation. Studio lighting is provided by a series of light strips mounted on crossbeams and the ceiling. Seventy outlets are available. In addition to the main studio there is an auxiliary studio with 600 sq ft of floor space and 9½ ft overhead clearance. Classrooms located in the immediate area of the studios are served by a closed-circuit underground coaxial cable system. Classrooms at a distance are served by means of a microwave channel. Signals are retransmitted from the microwave terminal to classrooms by coaxial cable.[142]

An adaptation of the HS-16WJ camera design of Benson-Lehner Corp. was used at Edwards Air Force Base to obtain qualitative data on shock vibration and temperature encountered near rocket nozzles during static firings. Because of the high temperatures involved a standard HS-16B High-Speed Photo Recorder was reduced in size and film capacity and inserted in a stainless-steel water jacket. A continuous flow of water surrounds the camera during the rocket firing enabling it to withstand temperatures estimated at 5000 F and velocities in excess of mach 2.[143]

The Tele-Tran System, a portable system designed mainly for military applications, was announced by Dage Television Div., Thompson Ramo Wooldridge, Inc. The battery powered 4-lb television camera and 12-lb transmitter is capable of transmitting live TV pictures over distances up to a half-mile.[144]

A new air-to-ground TV system, developed by Dage Television Div., was used to provide television coverage of the U.S. Air Force 7th Annual World-Wide Weapons Meet (Project William Tell) at Tyndall Air Force Base, Fla., Oct. 14–23 TV cameras both airborne and on the ground provided spectators with an unparalleled opportunity to observe all details of the maneuvers.[145]

The Southern Bell Telephone Company has provided a unique closed-circuit TV network at Redstone Arsenal, Ala. The Army is using this 19-point multiple pickup network to observe operating and maintenance procedures at missile launching areas. The system is also used to transmit information for briefing at Fort Knox, the Pentagon, etc.

Space Technology

The presentation of 10 papers on Space Technology and Image Sensing at the Society's 1959 Fall Convention in New York manifested one of the most significant trends of recent years. Equipments used in space exploration and satellite communication and experiments leading to the development of new techniques were described in detail. An example of present thinking in the area of possible future developments is the paper by S. W. Spaulding on "Television and Lunar Exploration," in which a television system specifically designed to operate at top efficiency within the environment of the Moon is described.

Requirements for a satellite camera were described in the paper by E. C. Hutter, J. A. Inslee and T. H. Moore on "Electrostatic Imaging and Recording." Experimental devices employing electrostatic image storage have been made. Among these devices are fixed phototape targets sealed in 6198 vidicon envelopes, fixed phototape targets sealed in camera tubes with electron multipliers, a demountable vacuum system with a tape transport, and a completely sealed phototape camera.

Overall, this group of papers may be considered as a comprehensive report both of what has been accomplished in terms of actual production of materials and equipments specifically designed for space communication, and the theoretical aspects of the exploration of space.

Developments in this field are so rapid and often so astonishing that the 1960 report on Space Technology may describe accomplishments that at this moment are completely unpredictable.

Television Recording

Video-tape recording continued to grow at a rapid pace, witness the delivery by the end of 1959, of 594 machines by Ampex and RCA, the two current manufacturers of commercial equipment. This represents a 200% increase over the 1958 total. The machines in service by December 1959 were distributed as follows:

221 units in 157 domestic commercial TV stations:

159 units in TV stations in 12 foreign countries;
76 units in use by the three national networks, 34 of which are capable of both color and monochrome operation;
72 units in U.S. Government organizations, industry and closed-circuit applications;
35 units in use by 17 domestic independent producers and production companies; and
31 units in an equal number of domestic educational TV stations.

During the year the National Educational Television and Radio Center, with the aid of a grant from the Ford Foundation, was authorized to purchase 43 video-tape recorders for delivery to an equal number of educational stations (although delivery was not completed by year end). Five additional machines are also available to the Center's headquarters in Ann Arbor, Mich. These will be used for duplicating taped programs contributed by the various educational stations. Thus, the world's first video-tape network is rapidly coming into being.

During the year the Canadian Broadcasting Corp. markedly expanded both its video-tape recording plant and its operations. A total of 21 machines are now in service at Halifax, Montreal, Toronto, Calgary and Vancouver, with further expansion anticipated at Ottawa and Winnipeg. Temporary installations also were made at St. Johns, Newfoundland and Halifax, Nova Scotia, to record the Royal Visit of the Queen.

The first mobile unit specifically designed for video-tape recording operations was introduced by Ampex during the year.[146] The growth in this field was so rapid that by the end of the year 21 organizations in five countries had 31 video-tape recording machines in mobile service. In addition, during the latter part of the year CBS made use of a chartered DC-4 airplane to transport a video-tape recording machine and associated television camera equipment to Europe and the Far East to record President Eisenhower's trip abroad.

The largest single application for video-tape recording, in terms of machine hours of use, continues to be for domestic network time-zone delay operations. It is not generally appreciated that during the six months of Daylight Saving Time two-thirds of all network affiliated stations (some 375 stations) serving approximately one-half of the United States receive their entire network program feed from video-tape machines centrally located in New York, Chicago and Los Angeles.

The total number of video-tape recording and playback machine hours was running in excess of 30,000 hours per month by December, 1959. Network operations accounted for about 50% and individual TV stations for approximately 35% of this total.

Until 1959 the Minnesota Mining and Manufacturing Co. had been the sole supplier of commercially acceptable video tape, but during the year, EMI (Electrical and Musical Industries, Ltd.) became a second source of tape for video-tape recording applications while Reeves Soundcraft announced a video tape to be made commercially available early in 1960.

The now famous Nixon-Khrushchev debate at the American National Exhibit in Moscow was televised with RCA color cameras, recorded on an Ampex color video-tape recorder and then flown to New York where CBS made thirteen copies for distribution to U.S. networks, individual stations and to the Canadian Broadcasting Corp. In addition, television recording (film) copies were made for distribution to others both here and abroad (including Russia).

Good progress towards standardization was made during the year by two industry committees working on the different aspects of the problem. The National Association of Broadcasters Television Advisory Committee on Video-Tape Usage was formed early in the year. This Committee is concerned with promulgation of standards and recommended practices for video-tape *operations*. This includes such matters as the program production information to be included in the proposed American Standard for tape leaders being formulated by the SMPTE, and the kind and type of information to be recorded on the cue track so as to provide universal cue marks useful in both manual and automated operations. In addition, the scope of the NAB's committee work includes shipping and storage procedures, identification and physical marking of tapes and tape containers, recommended practices for standard tape lengths to be used in commercials and standard procedures for tape splicing and for taped station and network identification announcements. Specific tape terminology for various production methods and for the several kinds of information recorded on tape is also under consideration.

The SMPTE's Video-Tape Recording Committee, which is now more than a year old, continued its work on the Recommended Practices and American Standards that will be necessary to insure interchangeability of tape recordings.[147] Two proposed American Standards (Specifications for Video Magnetic Tape Leader, and Dimensions for 2-In. Video Magnetic Tape Reels) were published in the November 1959 *Journal* (pp. 769 and 770). One Recommended Practice (Patch Splices) was published in the *Journal* for the usual three-month trial period and later approved, and two Proposed American Standards (Audio Record Characteristics, and Dimensions for Video, Audio and Control Records) were prepared for publication during the year and later published.[148] Work on two additional Proposed American Standards (Tape Dimensions, and Tape Speed) and one Recommended Practice (Monochrome Signal Characteristics) had been completed by the Video-Tape Recording Committee and forwarded to the Standards Committee for its approval, and later published.[149,150] Finally, there are three Proposed Standards (Control Track; Test Tape; and Recording Radius or Tip Penetration) and one Recommended Practice (Pre- and Post-Emphasis) in the process of being completed by the Video-Tape Recording Committee.

An event that may have tremendous significance both in the video-recording and motion-picture fields was the announcement in late December by William E. Glenn of General Electric of a fundamentally new recording process.[151] Known as thermoplastic recording, the process employs a high-melting film base coated first with a transparent conducting layer and then with a thin layer of a low-melting thermoplastic. An electron beam is used to lay down a charge pattern on the surface of the thermoplastic layer in accordance with the information to be stored. The film is then heated to the melting point of the thermoplastic. Within milliseconds forces between the charges on the film and the conducting layer depress the surface where charges occur. The film is then cooled and the deformations are thereby fixed in the surface.

The recording may be reproduced by means of diffraction optics. It may be erased by heating the film above the melting point of the thermoplastic. This increases its conductivity, surface tension smooths out the deformations and the film is ready for reuse.

Applied to the television recording and allied fields the process seems to have the potential of combining many of the virtues of both magnetic and film recording methods, such as immediate playback, erasability, visible image (for ease of editing and identification), copying at greater than a one-to-one rate and, if the image is in a motion-picture format, freedom from the video-tape problem of requiring scanning standards conversion before the material can be reproduced on foreign television systems.

Interchangeability of video-tape records made in the Unites States, Great Britain and Continental Europe was the purpose in the development of a standard convertor by Granada TV Network, Ltd., Manchester, England.[152]

Ampex announced a new television recorder VR-1000B and the RCA color tape recorder was put in production.[153]

A 525 mobile unit, the first completely self-contained taping facility on the American standard, has been developed jointly by Associated Television and the research department of the Pye Group of Companies, in association with a team of CBS experts, headed by Edward L. Saxe.[154]

TV Networks, Closed-Circuit, Cameras

Approximately 2300 channel miles were added to the U.S. television network in 1959, bringing the total to about 85,100 miles. About 3000 miles of coaxial cable were released from service, and more than 5300 miles of radio relay were added to the network. As of December 1959, network service was available to 658 stations in 419 cities, a growth of 48 stations and 16 cities since December 1958. During this period the total channel miles of the network equipped for color transmission increased to 82,133, a gain of approximately 3,600 channel miles.

Closed-circuit television is being used increasingly in various fields. On January 12, 1959, TNT Tele-sessions, Inc., arranged for an IBM-sponsored equipment introduction sales meeting originating in Los Angeles and fed to 133 locations in 112 cities.

The Patterson-Johansson fight originating in New York on June 26, 1959, was supplied to 143 locations in 195 cities by TelePrompTer.

On October 5, 1959, TNT again made available a closed-circuit TV network to IBM for a sales meeting originating in New York and fed to 103 locations in 90 cities.

Ampex announced the Marconi Mark IV $4\frac{1}{2}$-in. image-orthicon camera. This camera is said to offer superior quality, lighter weight, smaller overall size as well as improved signal-to-noise ratio. The camera and 7-in. viewfinder weigh approximately 90 lb.[155] Also introduced by Marconi was a lightweight (56-lb) vidicon camera. This camera is self-contained and incorporates all operating controls in addition to a 7-in. picture display and $2\frac{3}{4}$-in. waveform display.[156]

Sylvania developed a 15-lb vidicon-type camera for closed-circuit applications. This three-lens turret camera was designed for economy and ease of operation.[157] Also developed for closed-circuit television was a camera designed by Packard Bell Electronics. This equipment has single operating control, a fully regulated power supply, keyed automatic black-level control and an automatic light compensator.[158]

Color Television

Color broadcast network programing increased to approximately 20 hours a week. In addition special facilities were provided for outdoor sports including baseball, football and the Davis Cup tennis matches.

Technical improvements introduced during the year in color camera systems provided improved registration over the entire raster. This was made possible by development of precision focus and deflection yoke assemblies and precision image-orthicon tubes (RCA 7513)[159] and by using precision forming and winding jigs and techniques. The variations of the units were reduced by an order of magnitude. It is no longer necessary to match tubes or components for registry in a color camera.

The precision (RCA 7513) image-orthicon tube also uses a field mesh on the scanning side of the target. This minimizes beam-bending or dynamic misregistry errors and greatly improves the field flatness or electrical signal uniformity over the entire raster.

The dichroic plate sandwich color separation mirrors were replaced with "ice cubes" or dichroic prisms, eliminating completely the previously observed "ghost reflections" from the protective glass layers.

A high - sensitivity image - orthicon tube (7629) was introduced by the General Electric Company at WLW-T, Crosley Broadcasting Corp., Cincinnati, to pick up indoor basketball games under normal incident lighting of 50 ft-c. This tube has a new type of magnesium oxide target much thinner than the standard glass membrane of a standard tube. It gives promise of better resolution, freedom from image burn and longer life, in addition to its improved sensitivity.[160]

There has been widespread increase in color tape recording, bringing out the need for interchangeability between Ampex and RCA tapes. Such interchangeability has been achieved, provided that recordings are made in accordance with the SMPTE tentative standards which have been formulated. The factors which govern taping of programs are time-zone program storage, availability of artists at specified times, convenience of recording and editing. Such applications demand technical quality essentially indistinguishable from live color. While this goal has been met under carefully controlled conditions, much technical work is going into providing instrumentation to provide excellent results under all field situations.[161]

A four-camera color mobile unit was built by RCA for lease to broadcasters for special events or color pickup series.[162]

Color television in Japan is progressing rapidly in commercial programing. An RCA video-tape recorder was provided to Nippon Broadcasting Corp. to handle the syndicated Perry Como color tape program. Japanese color tape programs recorded in Tokyo have been played back on machines manufactured in the United States with excellent results (Oct. 22, 1959).

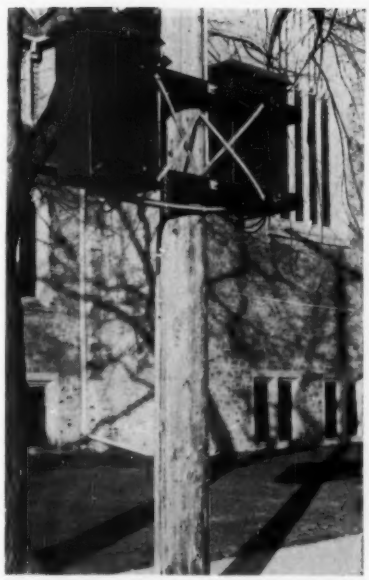

Fig. 33. Telemeter high-level amplifiers are installed on utility poles in West Toronto to feed signals and programs to subscribers to pay-TV.

The United States exhibit in Moscow[163] had as one of its attractions a complete color TV studio, originating eight hours of live, film and tape programing every day for the six weeks of the exposition. It was on the opening of this demonstration that the now-famous spontaneous exchange of views by Khrushchev and Nixon was recorded on video tape and later broadcast in America.

Continental Classroom, a college-level chemistry extension course, has been carried by NBC as a regular feature since September, 1959.

Pay Television

Unquestionably, the most significant development in the field of pay television during the past year was the announcement by Famous Players Canadian Corp. that a closed-circuit pay TV system would be installed in Toronto, Canada. The system was developed by International Telemeter Co., a Division of Paramount Pictures Corp. It operates three (3) channels of pay TV programing in addition to a program information channel. The Telemeter system which sells programs to customers who deposit cash in their home attachments has been described in preceding editions of the Progress Report.

The Toronto system which began operation in February, 1960, will initially consist of 96 miles of coaxial cable delivering signals to approximately 14,000 homes (Fig. 33). Famous Players' subsidiary, Trans Canada Telemeter, which operates the system, plans to have between six and seven thousand units installed in the West Toronto area by the Spring of 1960.

The studio for the pay TV system is capable of supplying film programing in black-and-white and color simultaneously and includes live studio and video-tape facilities.

European Television Network

This report describes the development of the television services in Europe participated in by Members of the European Broadcasting Union, with special reference to those that constitute the European Television Community, that is to say, those that form part of what is often called the Eurovision Network. This is, of course, not a network in the American sense of that term and the expression means in fact little more than that the technical means exist for the exchange of live television programs among the Members. Nevertheless whether such exchanges are large-scale operations planned well in advance, in which most or all of the nineteen Television Services participate, or smaller operations taken by only a few Services (often those using a single language) or simple topical interviews arranged at the shortest notice in a studio of one Service exclusively for a Service in another country, they must be properly planned and also supervised. This responsibility is undertaken by the European Broadcasting Union for the benefit of its Members. To this end, the Members' requirements on the programing side are coordinated by the E.B.U. office at Geneva, Switzerland, and the technical planning is effected by the E.B.U. Technical Centre in Brussels, Belgium, which also operates the Eurovision Master-Control Centre in the same city. Brussels is a convenient location for this Centre, as it constitutes an important focal point of the network of television radio-links spreading over Western Europe and it is possible there to monitor the signals of the three different television standards in use in Europe.*

It should be mentioned that these exchanges of programs are not the subject of financial transactions between E.B.U. Members. The programs are offered free of charge to the other Members of the Community although they are occasionally requested to reimburse the originating Member for any increase in performers' fees payable because of the wider diffusion of a program. Furthermore, for very large-scale operations, it is common practice for equipment and staff to be lent by one Service to another. It will be realized that the necessity to supply, in addition to the vision and "international sound" signals, up to perhaps fifteen different commentaries in different languages adds a complication that some of the smaller Services are unable to cope with without help from their neighbours.

General. On June 6, 1959, the European Television Community celebrated its Fifth Anniversary. During those five years it grew from eight Services to 19. Before 1959 the emphasis was on expansion. An idea of the general extent of the network is given as of December, 1957, by a map published in March, 1958.[164] Also, a map in the May, 1958, *Journal* shows the network in Italy.[165] With new technical facilities linking up TV services of additional countries and going farther afield within countries that were already connected, the dominant feature of Eurovision during 1959 has been consolidation. By this is meant that additional international vision junctions have been installed between countries that were already connected over other routes, additional channels have been provided over existing routes and new transit routes have been provided in order to facilitate the transmission of signals over the territory of countries, entirely independent of the traffic concerned with the TV services in those countries. These developments have resulted in much greater flexibility in the planning of exchanges; in greater reliability — both because of the availability of alternative routes and also because of the replacement, on many routes, of early equipment of less sophisticated design; and in a marked increase in the number of exchanges. The E.B.U. Master Control Centre in Brussels is now handling approximately twice as many international transmissions weekly compared with the situation at the end of 1958; and towards the end of 1959, it was decided to re-equip the Centre on a larger scale.

Continuing the trend noted in 1958, there was even greater emphasis on news and topical transmissions. In part this must be attributed to a service trial lasting four weeks during October, 1959, of a scheme for the daily pooling of newsfilms over the Eurovision Network. The full implications of this experiment are still being studied, but it has already shown the News Editors of the connected Television Services that the network can function as a very rapid means of distributing news-pictures. A new feature that began to have an effect on the operational plane during 1959 was the increasing use of video-tape recording equipment, but two shortcomings — apart from the high cost of the equipment — became evident. One is the impossibility of making the recording in one standard and reproducing it in another (a picture-tube recording on film, can, of course, be recorded from, for example, 625-line signals and in due course reproduced by an 819-line film-scanner); and the other is the impossibility of inserting a short taped sequence in a composite program without risk of a "roll" on switching to and from the taped item.

A few countries have reached the point where no further extension of television coverage is possible, using only the channels assigned to them in the Stockholm Plan (the internationally agreed arrangement of VHF frequencies in Europe) so urgent demands for service are being met by opening UHF stations, usually on an experimental basis. No UHF plan has yet been agreed upon internationally and no decision has been made on the conditions of using the UHF bands.

What the expansion of television in 1959 has represented in the European countries where Members of the E.B.U. are exploiting TV services is indicated in more detail in the following paragraphs.

Austria. The television network exploited by the Osterreichischer Rundfunk GmbH was augmented during 1959 by the addition of two new transmitting stations, bringing the total number to 15. At the end of the year, there were approximately 100,000 TV receivers in Austria. Work was proceeding on the provision of a permanent international vision junction with Switzerland, in addition to that with Western Germany. Temporary international vision junctions with Czechoslovakia and Hungary have been set up for special occasions and the possibility of providing permanent junctions with those countries is being studied.

In June 1959 the last part of the link between Vienna and the most western FM and TV transmitter of Austria on top of the Pfaender was put into operation. It was the connection between Patscherkofel and the Pfaender with relay stations on the Zugspitze and Valluga/Ulmer Huette (Fig. 34). The Zugspitze and Valluga are about 9700 ft high. The station on the Zugspitze is built into the mountain, just underneath the antenna tower. The top of the Valluga is not a good place for a relay station. On the Valluga are mounted two plane reflectors, which direct the signals from the Zugspitze and Pfaender to the Ulmer Huette on which the relay station is built. On the Zugspitze and Ulmer Huette there are no operating personnel.

Two transmission frequencies are used: 2-kmc is for the transmission of high-quality FM programs and several phone, signal and control channels; the 4-kmc signal has two broad channels, one for a TV signal and one for a big number of phone signals. This second

* That is to say, 405, 625 or 819 lines. As broadcast, there are in fact six different standards in use in Europe, but the other differences concern such features as the sense of vision modulation, synchronizing waveform AM or FM sound, channel width and the like, and have no effect on the transmission of the vision signals over the network.

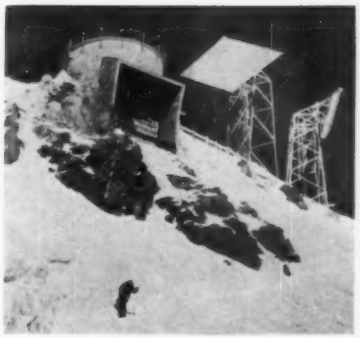

Fig. 34. The link between Vienna and the western point of Austria is completed: left, antenna tower on the Pfaender; center top, the two 350 sq ft reflectors on the Valluga; center bottom, relay station near Ulmer Huette; right, relay tower on the Zugspitze. (Photos Post- und Telegraphendirektion, Innsbruck)

channel could also be used for the transmission of a TV signal.

Belgium. In Belgium there are two separate TV services, one in each of the national languages, Flemish and French, exploited by the Institut National Belge de Radiodiffusion. During 1959 improvements in the radio-link network resulted in a sensible improvement in the transmitted picture quality. At the end of 1959, there were five TV transmitters and approximately 400,000 receivers in Belgium. Because in many parts of Belgium it is possible to receive television programs from the Netherlands, Germany or France, all Belgian television receivers are capable of receiving signals on the standards used in those countries, as well as on the Belgian standards.

Denmark. No new station has been opened by Danmarks Radio during 1959. Improvements have been made in the radio-link network, important extensions have been made to the principal studio center at Copenhagen and new outside-broadcast equipment has been acquired. At the end of 1959 Denmark had about 350,000 TV receivers.

Finland. 1959 was a year of considerable expansion in the TV service exploited by Oy. Yleisradio. Two new TV transmitting stations were opened, bringing the total up to eight. No proper vision junction yet exists between the Eurovision Network and Finland, but transmissions by the Swedish station in Stockholm are received on an island between Sweden and Finland and are thence relayed over a radio-link to Helsinki. Oy. Yleisradio can therefore relay a program from other countries of the Community, provided that it is broadcast to Stockholm, but cannot yet supply contributions to the network. There were some 25,000 TV receivers in Finland at the end of 1959.

France. The Radiodiffusion-Télévision Française achieved important improvements in its TV service during 1959 and the number of receivers increased by about one-third to 1,300,000. The number of TV transmitting stations increased from 38 to 46, not including a few very low-power stations that the RTF has authorized local authorities to erect on a temporary basis, until a satisfactory service is provided in these localities by an official station.

The international vision junction with the United Kingdom, exploited jointly by the RTF and the BBC, was superseded in June, 1959, by a junction provided and operated jointly by the French Telecommunications Administration and the British Post Office.

Federal Republic of Germany. In Western Germany and West Berlin, the different broadcasting authorities, which operate on a geographical basis, contribute programs to a single German Television Service. Technical developments have been particularly noteworthy in the microwave network operated by the Federal Post Office, which has been extensively re-equipped during 1959, with the provision of several channels along all the main routes. This makes it possible to inject contributions from any part of the country, or from abroad, with the greatest facility and flexibility. During 1959, the German broadcasting authorities decided to set up a main switching center at Frankfurt-am-Main. Network switching as such is at present performed by the Post Office at its nearby station on the Grosser Feldberg, but this is entirely a technical operation and it was thought desirable to provide for control of programing — the "continuity" function — under the supervision of program staff.

During the year, 18 new TV transmitting stations were added to the West German network and there was a very satisfactory increase in the number of receivers in use — a rise of more than 50% to 3,400,000. Eight of the stations are working in Band IV, that is to say, on UHF, on a provisional basis. In all, there were 159 television transmitting stations in operation in the Federal Republic and West Berlin at the end of the year, many, of course, of quite low power. This total does not include two UHF stations working according to the FCC 525-line standards, installed for the benefit of the U.S. Armed Forces stationed in Germany. Important expansion has taken place also on the studio side and several of the Television Services have provided themselves with new studio centers or have extended their existing centers. Video-tape recording facilities have been introduced at several centers, including a mobile unit based at Baden-Baden.

Italy. The Radiotelevisione Italiana has added during 1959, no fewer than 32 new stations to its network, bringing the

total up to 351. Many, of course, are local-service stations of quite low power, made necessary by the very broken, mountainous nature of many parts of Italy. These stations are fully automatic and rebroadcast the signals radiated by another station, sometimes as many as five or six functioning thus in cascade.

In Italy the year has seen a very important increase in the number of receivers, from 1,100,000 in January to 1,500,000 at the end of 1959.

Yugoslavia. The television network of the Yugoslavenska Radiodifuzija is not yet able to contribute programs to the Eurovision Network, but it can take the Network programs by direct reception from one of the Italian stations. At the end of the year there were five TV transmitting stations working and about 15,000 receivers in use.

Luxembourg. There was no very important development during 1959 in the TV service of the Grand Duchy of Luxembourg. The 100-kw e.r.p. station of the Compagnie Luxembourgeoise de Télédiffusion radiates on an 819-line standard. The international junction is between Luxembourg and Metz, France. There are about 4000 TV receivers in Luxembourg.

Monaco. The area of the Principality of Monaco is so small that it was necessary to locate the TV transmitting station in France, on Mont Agel which dominates the Principality. As Mont Agel is also a radio-relay station on the vision junction between France and Italy, this is a very convenient arrangement for exchanging programs. Monaco has about 10,000 TV receivers.

Netherlands. During 1959 the whole of the radio-link network in the Netherlands was reorganized and re-equipped with apparatus of the most recent design. The main vision-switching center was transferred from Bussum to Hilversum and switching at the bifurcation points is now effected by remote control from the switching center. During January, 1959, the fifth and last of the main transmitting stations was opened, and one of them was transferred just before Christmas to its final site. There are about 700,000 TV receivers in the Netherlands.

Additional temporary studio facilities were provided to serve until the new Television Centre, now in construction at Hilversum, is ready for service. Extended facilities for TV recording were also provided during 1959.

Norway. The Norsk Rikskringkasting is a relative newcomer to Eurovision, as the international junction with the Swedish network was completed only toward the end of 1959. So far, only a single transmitting station is functioning and during the year the number of receivers in use rose from about 500 to about 6000.

Portugal. The television service of Radiotelevisão Portuguesã is not yet connected to Eurovision Network. There are five stations in service, as at the beginning of the year and the number of receivers is about 50,000.

Spain. The television service of Radio Nacional de España is not connected to the Eurovision Network, but work is in hand on the project and it is hoped to establish the international junction with France in the course of 1960. An extension of this, by way of the Balearic Islands, is expected to provide a vision link with Algeria. Hitherto it has been necessary to employ a high-flying aircraft as a relay station when the RTF wished to effect a link between metropolitan France and Algeria.

The television stations of Madrid and Barcelona are joined by a radio-link chain and there are two other stations at present operating autonomously. The number of receivers in use is believed to be about 150,000.

Sweden. Television effectively began in Sweden in 1958 with a large-scale coverage of the World Football Championship. Since that date there has been very rapid expansion and an important network comprising 21 transmitting stations is now being exploited by Sveriges Radio. The Swedish Royal Board of Telecommunications has provided a main radio-link chain axially across the country, with provision for simultaneous two-way transmission and junctions with Denmark, Norway and, during 1960, with Finland. The number of receivers rose from about 200,000 to 600,000 during 1959.

Switzerland. The Schweizerische Rundspruch Gesellschaft operates a three-part TV service, divided on a geographical basis, in French, German and Italian. One high-power transmitting station was added to the Swiss network during 1959. International vision junctions existed with France, Western Germany and Italy — the last-mentioned by way of the long trans-Alpine chain over the Jungfraujoch — and preparations are being made to install a junction with Austria during 1960. When this is opened, Switzerland will become an important focal point of the Eurovision Network, but the development of vision channels over the different routes independent of those for the Swiss programs will be required before its possibilities can be fully exploited. The number of TV receivers in Switzerland at the end of 1959 was about 70,000.

United Kingdom. Continuous important developments have occurred in the TV service in the United Kingdom during 1959 both in the British Broadcasting Corp. and also in the Independent Television Authority and the program contractors — two new contractors were appointed in 1959 — that provide the programs radiated by the ITA. On the transmitter side, the BBC has, during 1959, opened one new station and has replaced three temporary stations, whereas the ITA has completed five new stations. BBC had in operation at the end of the year 23 transmitting stations and ITA, ten. On the studio side, both the BBC and the independent television companies have large studio centers in construction in London, but neither center was due for completion during 1959. Both services opened new studio centers in other parts of the Kingdom, notably the BBC automatic studios with remote-control cameras at strategic points for short-notice interviews and topical reports. Both services, too, have introduced static and mobile video-tape recording facilities on a fairly large and increasing scale, as well as facilities for conversion between the European and American standards — a conversion that poses severe problems because of the 10-cycle flicker resulting from the difference between the 50-cycle and 60-cycle field repetition frequencies.

An important BBC development, first utilized operationally in 1959, is the "cable-film" system for transmitting short news-films over the transatlantic telephone cables. The method is based on the principle of exchanging bandwidth for speed of transmission.

The number of TV receivers in the United Kingdom rose during 1959 from just under 9 million to a little more than 10 million.

Conclusion. Such, then, is a brief general view of television in Europe from the broadcasters' point of view and considering only the technical plane, as it presented itself in 1959. For an event of general interest, it is evidently possible — and this is not only a technical possibility, but also what actually occurs — for 670 stations to be interconnected as a single network, serving a total of about 18,800,000 receivers (a figure which is by no means exaggerated). Allowing an average of three persons viewing each receiver, this represents a total audience of about 54,000,000.

Africa

There is not very much to report this year other than reported last year, as the position has remained virtually static in South Africa, with the exception of the financial failure of Film Production Facilities in Irene, which subsequently

were taken over by Irene Film Studios and re-established.

There has been a slight increase in the one-man studio unit in view of the fact that the adjoining territories of Northern and Southern Rhodesia are establishing very soon a Television Network for which small operators in South Africa are preparing for the supply of TV news.

Although the South African Government has publicly denounced television in South Africa, it is the fond hope of all in this country that within the next two or three years, television will be introduced in response to the overpowering demand of the public itself. One of the main problems is that, South Africa being bilingual, it will be essential to establish two stations, one for each language, which in this sparsely populated area will be uneconomical. Also, because there is not sufficient talent or program material of a local nature, to keep going full time would require many "canned" programs, which will not be available in the Afrikaans language.

When television is eventually introduced, a complete change may be expected in the motion-picture industry in South Africa.

At present, all cinema houses are virtually controlled by the 20th Century Organization, but a chain of drive-in cinemas, operated by independents, is springing up throughout South Africa. These houses are being used for the release of films other than those represented by the 20th Century Organization.

Motorists who park on the road opposite the drive-in theater at Randfontein and enjoy free cinema shows, will be ticketed in the future. The screen can be seen clearly from the road and dozens of cars park there every night. A cinema in Randfontein has closed down since the drive-in opened three months ago. The Randfontein Town Council has instructed the Traffic and Licensing Department to erect "No Parking" signs along the road because the cars are a danger to traffic.

In Central Africa, the first industrial film company, Associated Rhodesian Telefilms, was established in Salisbury, Southern Rhodesia. The firm, organized and owned by Geoffrey Mangin, produces mainly 16mm films.[166]

Another development was the establishment of two television stations in West Nigeria, located at Ibadan and Abafon. Studio equipment was supplied by Marconi Wireless Telegraph Co.[167]

Australia

By the end of the year television services had been in operation for three years in Australia's largest cities — Sydney and Melbourne. The popularity of TV services with Australian viewers has been reflected in the rapid growth of the industry, which produced 370,000 receivers during the year, making a total of more than 950,000 in the three years.

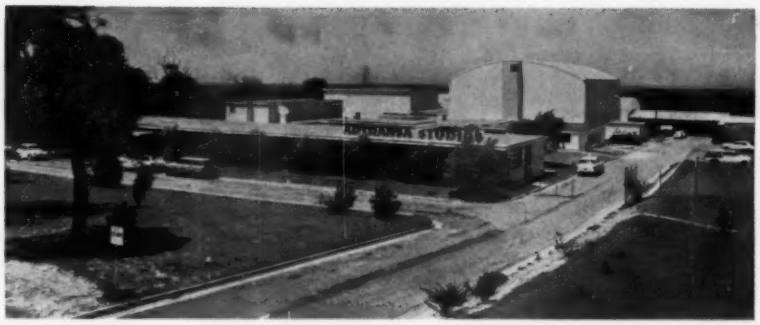

Fig. 35. Artransa's modern studio in French's Forest, near Sydney, with 130 acres of bushland nearby where a town has been built for "western" productions.

The trend in 1959 was toward 21-in. or larger receivers which accounted for 92% of production in October by 28 set manufacturers and six picture-tube makers. Television receiver development during the year is summarized by G. Mak, Engineer-in-Chief of Philips Electrical Industries Pty. Ltd. as follows:

"The changeover to 110° deflection was completed in 1959. The general quality of the 110° image has been high. Some manufacturers have introduced dynamic focus to obtain uniform spot size on the whole of the screen. Pincushion and barrel distortion figures have been kept very low and it can be said that most deflection component manufacturers have been able to maintain distortion figures comparable to those of the 90° components.

"Although remote control has been on the market in previous years, these controls did not include channel changing. In 1959 two manufacturers introduced remote channel changing and one of those introduced remote control by means of supersonic sound. A downward trend in prices has continued. Although the latest figures on saturation in Sydney and Melbourne are not available, I believe it to be of the order of 60% and this high saturation was responsible for the start of a second set market.

"The start of transmission in Perth, Adelaide and Brisbane has opened up some more fringe areas and certain manufacturers have been concentrating on capturing these markets by specially selected and fringe aligned sets. So far, however, no special techniques have been used as, for instance, exalted carrier techniques.

"As far as general television components are concerned, 1959 saw the introduction of low noise frame grid tubes for tuners, a more general use of silicon diodes in the power supplies and a general improvement in quality of paper, electrolytic and plastic film capacitors. Also grain oriented steels were introduced in the design of frame output transformers and power supply transformers.

"Philips has introduced horizontal and vertical stabilization of the deflection circuits. With this stabilization the height and width of the image are constant. Mains voltage, brightness and contrast setting have no influence on the width and height, also the E.H.T. is constant."

During the year TV services were extended, under Stage Two of the Australian Broadcasting Control Board's plan, to Brisbane and Adelaide, each with two commercial and one Australian Broadcasting Commission (Government noncommercial) stations. In Perth, one commercial station commenced operation and one ABC station was under construction. In Hobart, Tasmania, where one commercial and one ABC station will be provided, progress was made with the construction of city studios and transmitter installations on nearby Mount Wellington. Extensions during 1959 brought television service within reach of a total of more than five million people.

During the year the Federal Government decided to proceed with the third stage of the plan for the introduction of television. Applications were invited for commercial television station licenses in Canberra, Australian Capital Territory; and twelve provincial and country centers.

This year saw the first direct interstate relay of television programs when a test cricket match in Sydney was simultaneously telecast in Melbourne. The 500-mile link was set up using the combined remote link equipment of one station in Sydney and another in Melbourne.

Work was commenced on the coaxial cable which will provide permanent coaxial television relay circuits between Sydney, Canberra and Melbourne and will also provide for great expansion of the telephone and other communication facilities between these centers.

The use of video-tape recording, which had been available only in Sydney, was extended to associated stations in Melbourne, Brisbane and Adelaide, providing a high-quality medium for the exchange of locally produced programs.

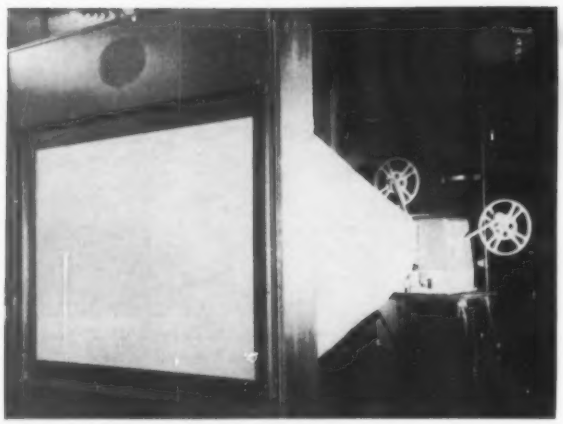

Fig. 36. Arrangement for showing 16mm films in limited space.

Fig. 37. Equipment at Van de Water Films, Inc.

There was a definite increase in motion-picture production in Australia last year. The major portion of production was for use on television although there was considerable activity in feature films.

Stanley Kramer finished *On the Beach* in Melbourne. Kramer was the first overseas producer to use the facilities of a local laboratory to develop the negatives, all negatives formerly having been sent by air freight to the United States or England for processing. Supreme Sound did the job.

Fred Zimmerman made location scenes for *The Sundowners* for Warner Bros. Associated British Pictures used Artransa's facilities for location shots of *The Flying Doctor* and Ben Fox has Artransa at work on *Whiplash*, 39 episodes set in the outback of Australia (Fig. 35).

The quality of production shows great improvement after a year's experience. Further shipments of German Laboratory Equipment have been installed in local laboratories. Pagewood is building another sound stage along the latest Hollywood lines. The Supreme-Pagewood combination has completed 13 episodes with Winifred Attwill at the piano.

With new TV stations opening in 1960, the industry will certainly be inspired to make more local productions that will be up to export standards.

Canada

Canadian motion-picture producers have increased greatly in number in the last ten years, and are employing up-to-date methods. The use of both background projection and traveling matte processes was begun in 1959, robot printing gained headway, and telecine equipment is employed for evaluating negatives without making positive prints. The increasing demand for technical equipment stimulated improvement and development. New items include a compact test chamber for microphones, a portable 16mm screening outfit for short throws under high ambient light level, a filmstrip loop printer, high-speed 16mm inspection screening projectors, adjustable strong steel shelving for horizontal or vertical storage of film in cans up to the 2000-ft size, and an adjustable backstop for rewinds. Improvements to existing equipment include a better pressure plate for 16mm cameras, an automatic dissolve and fade mechanism, and an animation stand camera converted for double frame (Leica format). Among new facilities may be cited a sound booth, a reverberation chamber, and storage vaults for acetate film. These are now considered in some detail.

One of the more interesting developments in the film industry in Canada is the introduction of special effects techniques to achieve economies in location shooting. Where there is less money for commercials and short subjects, there is great need for any means to give the effect of a large stage setting at minimum financial outlay. Peterson Productions Ltd. of Toronto is, to our knowledge, the first Canadian producer to employ the traveling matte process. Black-and-white subjects are photographed against a blue background, using Eastman color stocks. The method by which both matte and subject negatives are obtained is well known. The National Film Board (NFB) of Canada is employing background projection for settings for subjects on shooting stage. Both moving and still pictures have been employed in different productions. Location cameramen have been issued still cameras for obtaining scenes for background projection on the stage. Painted static mattes are also being used.

A setup for screening 16mm films in tight quarters under adverse light conditions was developed at NFB for its Distribution Branch. The first model (Fig. 36) incorporated basic projection ideas: a 32 by 42 in. Polascreen projection screen with a 16mm Bell & Howell projector situated 6 ft behind, and the beam enclosed by a cloth cone. To enable the projector to be turned parallel to the screen, a mirror is installed at 45°, close in front of the lens. A portable form of screen was developed. Plywood wings at the side of the screen shade it from unwanted light, and also protect it for shipment. The speaker hangs beneath. This rear projection outfit is useful in small classrooms, and also as a temporary installation for attracting pedestrian audiences at fairs, airport terminals, etc.

Figure 37 shows some of the equipment of Van de Water Films Inc., a progressive newcomer to the Montreal scene. The sound booth is used with a soundproof studio, 30 by 25 ft, in the production of documentaries, commercials, semidramatic films and post-synchronization. Equipment includes interlocked projection-recording facilities, sound-effects tables (three turntables with variable-speed motors and strobe control) for mixing purposes, six dubbers, Westrex transistorized mixer #RA-1627-A with built-in compressor, oscillator, radio and telephone effects; optical recorder #RA-1581 variable area, dual bilateral track for direct positive and negative; magnetic recorder and optical-magnetic reproducer #RA-1509. Cutting rooms are well equipped.

A compact test chamber for routine testing of microphones, designed by R. W. Curtis of NFB, was the subject of a paper presented at the Society's 1959 Fall Convention in New York.[168]

A reverberation chamber was constructed at NFB, with poured concrete walls 8 in. thick. Figure 38 is an interior view. The inside dimensions are roughly 17 by 20 ft and 15 ft high. It contains a speaker and microphone connected with the dubbing console in the re-recording studio.

The pressure plate on 16mm cameras was modified by the NFB Camera Maintenance Section to hold the film flatter

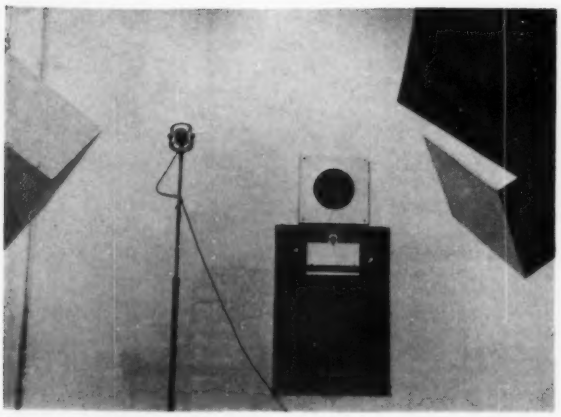

Fig. 38. Interior of reverberation chamber at NFB shows speaker and microphone which are connected with the dubbing console in the re-recording studio.

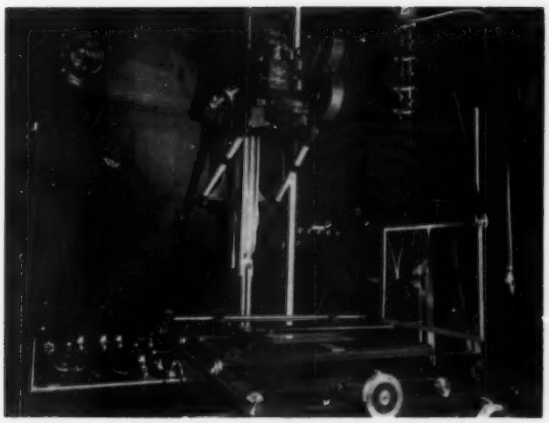

Fig. 39. Automatic dissolve and fade mechanism applied to animation stand cameras.

and to eliminate scratching. The plate supplied with the cameras has only a spring-loaded steel ball to support the center of the film. The new plate has two small nylon rollers instead, and its use has improved picture sharpness as well as stopped scratching.

An automatic dissolve and fade mechanism was devised at NFB and applied to animation stand cameras (Fig. 39). It involves a cam with log and sine curves at the camera, and a control panel beside the operator. The transitions can be made to occupy various lengths of film in multiples of 16 frames. The two vertical strips with curved ends seen in front of the upright column are follow-focus cams, one for 16mm work and the other for 35mm. One of the animation cameras has been converted to take double-frame pictures (Leica format).

The common rewind was made more convenient for core winding by the addition of a cast aluminum sub-base carrying a sliding backstop. When winding on reels, the vertical retaining arm is shoved to the back. The unit, made in NFB shops, produces smooth, tight winds.

A high-speed 16mm projector (Fig. 40) was made up at the NFB to speed up the inspection screening of 16mm prints which constituted a bottleneck. This was achieved by converting 35mm projectors to take 16mm film and running them at their normal speed of 90 ft/min which is $2\frac{1}{2}$ times faster than normal for 16mm film. Two 16mm frames are projected at once including the soundtrack. Any weave is readily detected. After inspecting the initial print of a multiple print order on a conventional projector, subsequent prints are then checked silently on the high-speed units. In converting the projector mechanism the film path was altered, and soft starting motors were installed.

Robot printing was introduced in the NFB by installing Bell & Howell automatic shutter control units on Bell & Howell Model J printers. The speed of the units was increased from 120 to 150 ft/min.

A loop printer for producing many prints from one negative 2 to 8 ft in length was constructed in the NFB shops (Fig. 41). It was built around a Model 1502 Herrnfeld filmstrip printer, which is the rectangular plate containing all the mechanism at the upper portion of the cabinet. Two slotted vacuum rollers were installed to remove loose dirt from the emulsion and base surfaces. An adjustable elevator was added beneath to support the loop of negative. The operating speed is 45 ft/min. A counter actuated by a timing notch prevents overprinting of an order. After a run of 1500 prints the duplicate negative was found to be in nearly perfect condition and the last print was as clean and free from scratches as the first print. Under the old system at least 10 dupes would have been required and there would have been many print rejects.

Film storage facilities at the NFB were greatly increased in 1959 with the completion of a two-story brick vault building. Since only acetate material is stored in the building, the storage rooms are 54 by 104 ft and 12 ft high, without any explosion vents. The air is maintained at 68 F and 55% relative humidity. Two interesting features resulting from the increase in vault space are the new storage rack design and the use of closed-circuit TV inversion for viewing positive images from large holdings of archival negatives for which no positive prints exist.

The steel storage racks or shelves are a modification of the standard adjustable library book shelving of a Montreal manufacturer, B. K. Johl Inc. The chief ways in which these racks are novel are: (1) The "shelf" consists of two bars of $1\frac{1}{4}$ by $1\frac{1}{4}$ in. of $\frac{1}{8}$-in. angle iron, spaced $5\frac{1}{4}$ in. apart. (This permits the filing of cans of all sizes between 400 ft and 2000

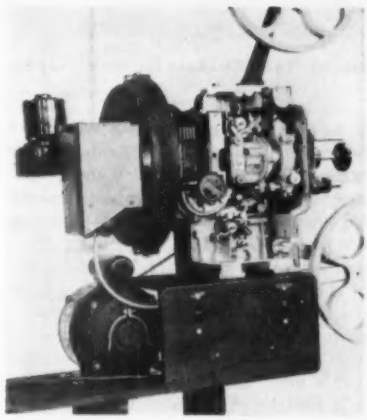

Fig. 40. Projector for screening 16mm prints at high speed.

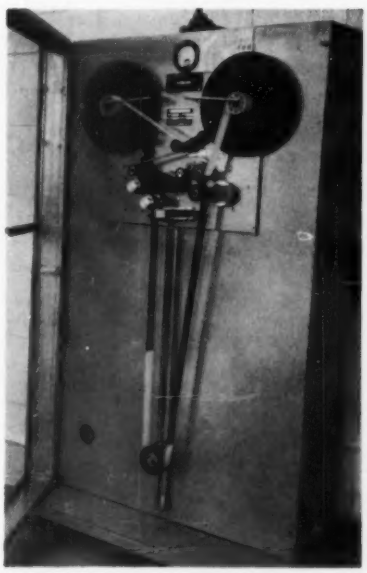

Fig. 41. Loop printer built around a Model 1502 Herrnfeld filmstrip printer.

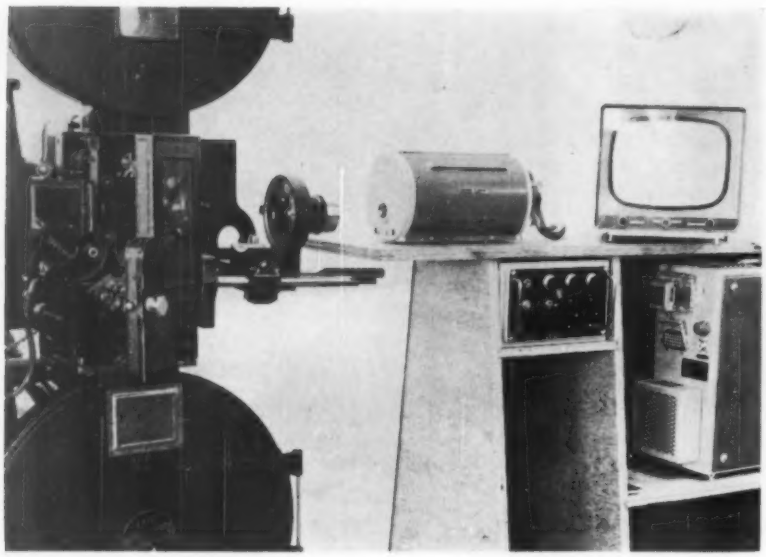

Fig. 42. Telecine chain for examining negatives.

Fig. 43. Transistorized portable vidicon camera equipment, Fernseh GmbH.

ft, square or round, in either vertical or horizontal position); (2) the backing is made of flattened expanded metal (not sheet steel) to facilitate ventilation; and (3) the columns are not free standing but are anchored to the ceiling by a method which allows for 1-in. deflection of the floor above. The end brackets of the adjustable shelf sections are stronger than those used for book shelves. Loading tests revealed that all parts of the rack had a generous factor of safety.

A telecine chain consisting of a modified projector and a Pye industrial TV system for examining negatives was constructed in NFB shops (Fig. 42). It is adjusted to show positive pictures on the TV screen when negative images are projected into the camera. This eliminates the expense and delay of making positive prints for evaluating negatives. The projector shown at the left was modified to handle shrunken film.

An important program of the Canadian Broadcasting Corp., "An Engineering Approach to Television Film," was reported in a substantial three-part paper by L. J. Murch, Harold Wright and Rodger J. Ross.[169]

Egypt

There is nothing new to report this year except that The Cinema High Institute has been opened to supply the field of the motion picture with well-educated technicians in all phases.

The total number of feature films and shorts produced this year showed no decrease over the previous year's total, but the coming year will see quite a change in increased production owing to the new buildings of the Misr Studios that will be equipped with new and up-to-date equipments.

A new television station for the U.A.R. is expected to start operation on July 23, 1960, the eighth anniversary of Revolution Day.

France

Cameras. New models were introduced on the French market at various times during the year. For studio views, André Debrie Mfg. Corp. has achieved a prototype of a camera for horizontal running of 35mm film, provided with an electronic reflex viewfinder enabling the control of the image on a panel screen at the same time. The electronic system has been built by the Laboratoires de Physique Appliquée, and allows control of the brilliance of any given point in the field.

Recent improvements in the 16mm cameras may be noted. The 16mm Eclair camera, with changeable magazines, incorporates a signal-emitting device for post-synchronization with a magnetic tape recorder. Another 16mm camera, announced by Debrie, incorporates a device for sound recording on a magnetic track coated on the raw film, negative or reversal.

Worth mentioning is the auto-collimator Totalvision which increases the accuracy in focusing the lenses of the cameras.

Film Producing. A feature film, made by M. Lamorisse, was filmed, in large part, from a helicopter; for this purpose, a special hanging device was manufactured to support the camera and avoid vibration effects caused by the inertia of the camera.

For views in bad weather conditions (rain, gale, etc.) a closed box with a high-speed rotating window has been developed.

In the studios, a technique of molding set elements with new plastics has been introduced. The precision obtained in the details is much more accurate than with staff; furthermore, the elements are lighter and much more resistant.

Laboratories. Equipment of printing laboratories is improved for obtaining special effects, and for the purpose of gathering views taken with different methods (wide film, anamorphic image, etc.). A new optical printing machine called Multi Rex permits adaptation of the projection system either for vertical running (four perforations) or for horizontal running (eight perforations). The pulling mechanism is of the "beater" type and is characterized by a special device for adjusting the run of the pins by stops.

To be noted also is the Debrie anti-scratch printing machine, for minimizing or suppressing defects due to scratches on the original negative. The printing takes place in a liquid gate.

As for color printing, the laboratories are now equipped with timing machines, specially built for automatic exposing of the test strips, from which the exact timing of each view is determined.

Projection. Few notable advances have been made in the field of projection and theater equipment. The projection booths are now more frequently placed perpendicularly to the axis of the screen, and form a built-in part at the balcony.

A new device, to improve the distribution of foreign-language films, has been announced by the Société d'Application Technique et d'Exploitation Cinématographique. It is an automatic subtitle projector, synchronized with the usual film projector. The subtitling is then simplified. The original copy is not submitted to any alteration. The system

Fig. 44. (A) Picture taken with image orthicon without field mesh in scanning section; (B) same picture with field mesh.

has been demonstrated on several occasions, in Tours, France, and in Moscow.

Germany

Television Camera Equipment. At the Convention of the Fernsehtechnische Gesellschaft, September, 1959, a fully transistorized portable TV camera was demonstrated by Fernseh GmbH, Darmstadt. It can be carried easily by one person. A vidicon camera is used with an optical viewfinder; the transmitter operates in the UHF frequency band IV. The total weight of this equipment is 11.4 kg (about 25 lb), and the power supply lasts up to 4 hours (Fig. 43).

Sensitivity of the image-iconoscope tube made by Fernseh GmbH, a type still used in many TV studios in the Federal Republic of West Germany, was increased by a factor of about 2 by the introduction of better photocathodes. The improved tube now works with an illumination of the scene of about 1200 Lux (lumens per square meter). It is considered that a further increase in sensitivity will be possible in the near future by using tri-alkali cathodes. Regarding the image-orthicon, more tubes with field-mesh in the scanning section are being used (RCA 75 13; Fernseh GmbH OS 20F, EEV P809). Such tubes have fewer borderline effects and less small detail distortion especially less distortion of vertical black to white transients). Figures 44A and 44B show by comparison how much the general picture quality is improved.

Measuring Technique. An agreement was reached between the broadcasting organizations of West Germany and the Deutsche Bundespost concerning the level scale according to the IRE standards introduced in the United States (IRE Standard 50 IRE 23.51, "Standards on Television: Methods of Measurement of Television Signal Levels, Resolution, and Timing of Video Switching Systems, 1950). Test waveforms, which may be inserted during scanning line 12 of the vertical blanking interval, were specified as reference white level, stairstep, and white level bar. (See also the 1958 Progress Report in the May 1959 *Journal*.)

Magnetic Tape Video Recording. During 1959, 12 Ampex Videotape Recorders were put into service at the TV studios of the Federal Republic. The percentage of TV programs on tape is steadily increasing, but the rate is still below 10% of the total program time. At the Südwestfunk, Baden-Baden, nearly all TV plays are prerecorded on tape. The percentage will certainly increase, if the announced improvements concerning the frequency response, the exact synchronization from the studio pulse generator, as well as an improved cutting and editing technique turn out to be successful. At the Institut für Rundfunktechnik, München, it was found that by improvements of the whole electronic transmission channel the quality requirements for the 625-line CCIR standard (5-mc) could be well satisfied (Fig. 45). These developments show that the tape itself cannot be considered as a severe limitation for further development.

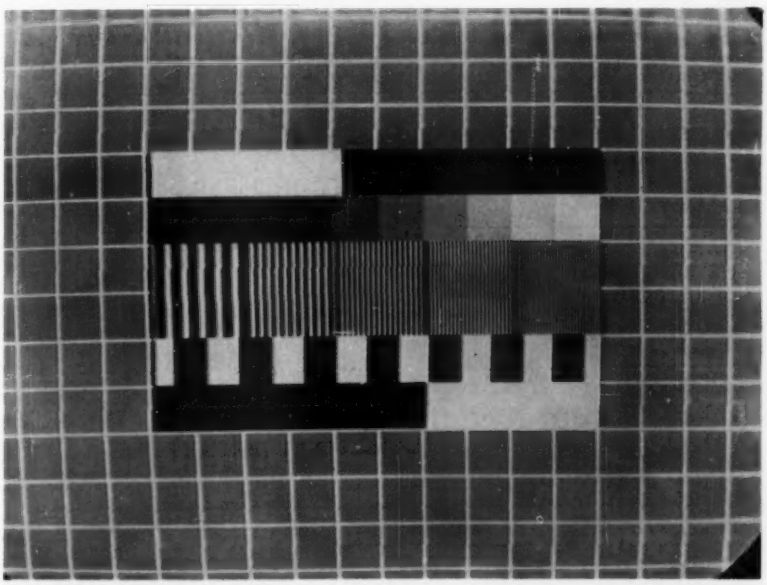

Fig. 45. Electronic test pattern recorded on improved video-tape recorder; frequency groups range from 1 to 5 mc.

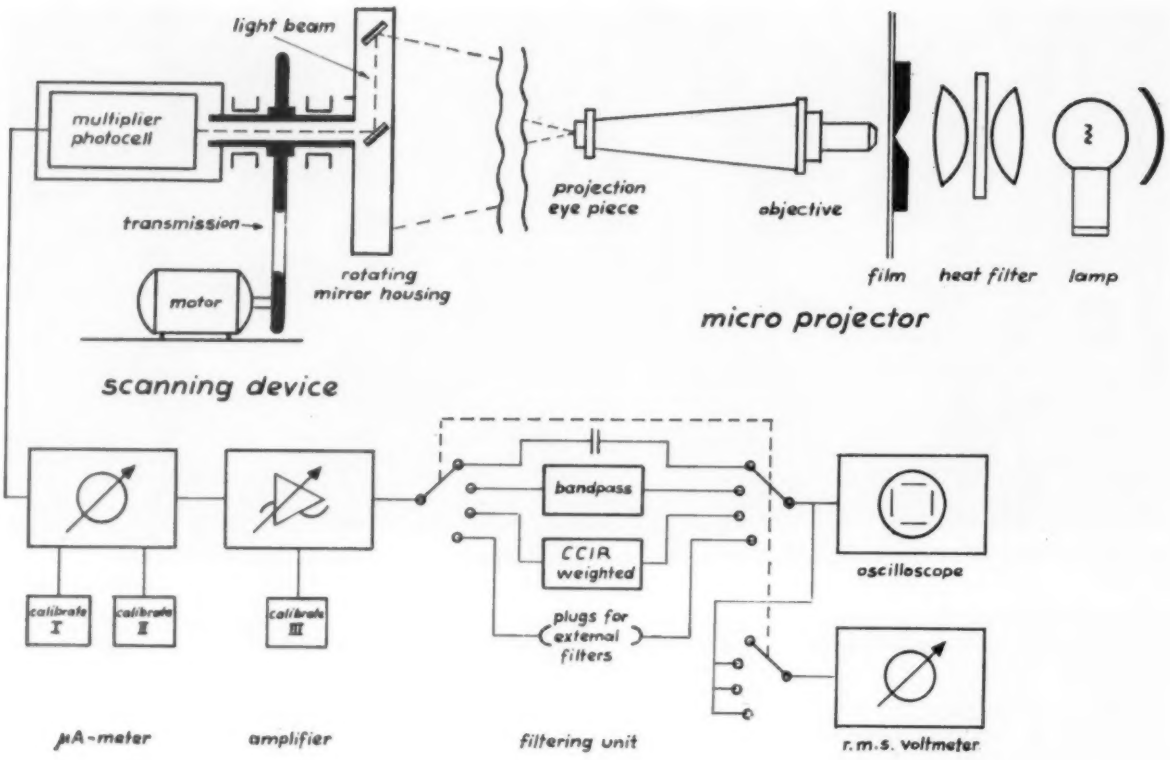

Fig. 46. Scheme of film scanner.

Newsfilm. Newsreel production with synchronous sound according to the pilot-frequency system has given satisfying results in TV service (see also Progress Report 1957, 1958). In the meantime, the level constancy and crosstalk of the recorded pilot frequency have been improved by the introduction of high-frequency bias. This was made possible by the development of a new pilot head (Telefunken) which does not require more than 100-mw bias energy and which therefore can also be used for lightweight equipment.

Film Recording. Film recording in television is being replaced more and more by video-tape recording; nevertheless, the film recording method is still considered to have some importance. Reversal film has been generally used to achieve good resolution with little graininess, but it was recently found that at least the same quality can be achieved with a new technique, by which a negative picture is written on the screen, exposing a negative film (negative/negative method). High gamma correction of the signal fed to the picture tube is necessary to compensate the negative characteristic of the screen and the nonlinear transfer characteristic of the negative film. The results of the new technique are so encouraging that the negative/negative method has been put into service at a number of TV studios.

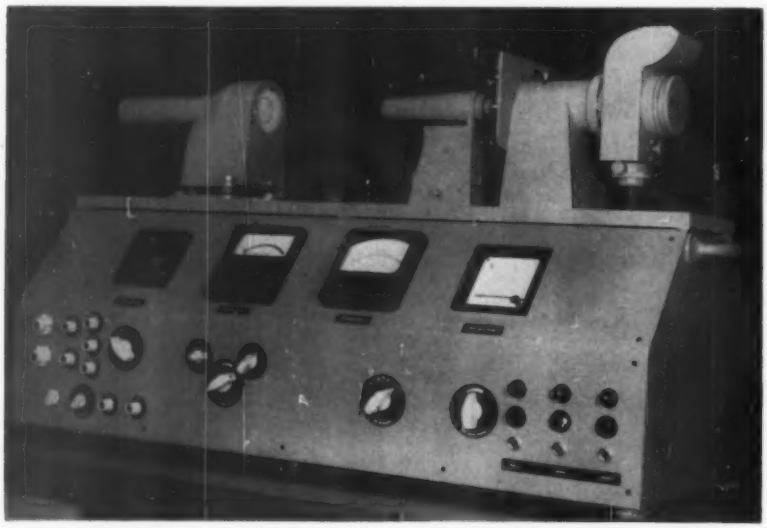

Fig. 47. First model of film scanner.

Film Scanning Technique. A new film scanning technique has recently been introduced. The scanning device developed by the Bayerischer Rundfunk is shown in Fig. 46. The part of a film picture to be examined, is projected on a measuring surface by means of a microscope optic (enlarging about 100 times). In the plane of the enlarged image, a disc with a small aperture (picture element size) rotates at 1800 rpm. The scanned area lies within one field of the gray scale of the test picture on the 16mm film. The light flux taken by the scanning aperture is transferred by a mirror system on to the photocathode of a multiplier photocell.

The equipment allows the measuring of the "transmission characteristic" (multiplier current is proportional to the transparency), the "frequency response"

(contrast or depth of modulation response of line-rasters 1–5 mc/sec, reading on oscilloscope) and the "signal-to-noise-ratio" (measured within the TV frequency range as peak value on oscilloscope and as rms value by using a weighting network according to CCIR recommendations).

The first prototype of the film scanner (Fig. 47) has proved to be successful in practice and it is now in production by Steffelbauer, München.

Other TV Activities. During 1959 the number of TV licenses registered at the Deutsche Bundespost increased to more than three million. At the broadcasting stations more UHF (band IV) transmitters have been put into service.

Motion Pictures. Siemens Klangfilm have constructed a 16mm optical sound recorder for direct recording or transcription from magnetic film to optical sound (Fig. 48). The recorder consists of a 16mm machine, similar to the previously described Magnetocord 16mm M/R recorder and reproducer with an additional optical recording system attached to it. The recorder can be used in connection with a Magnetocord 16 M/R, in duplex operation for recording on magnetic film and following transcription on optical soundtrack, and is constructed for operation in a darkroom.

Zeiss-Ikon has used the advantages of xenon lamps by developing a background projector for stills, equipped with a 2000-w xenon lamp (Fig. 49). This projector can be used for film and TV productions or on stages and has the great advantage of very simple operation, comparable with that of incandescent lamps. An air-cooling system enables use over a long period of time without damaging the bias. The light output is approximately 10 lm, using slides 8.5 by 10 cm. A slide adaptor for various sizes can be supplied. Behind the lamp is a cold-light mirror and a honeycomb condenser in the light beam. In case of space problems a mirror in front of the lens allows for projection "round the corner" (Fig. 50).

During 1959 quite a number of theaters in large cities in Europe installed

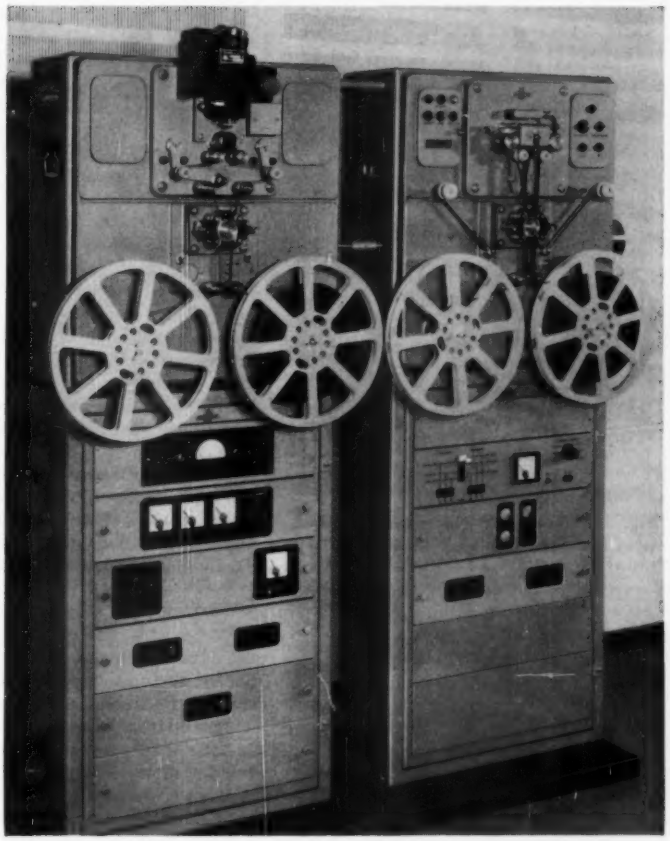

Fig. 48. Siemens-Klangfilm 16mm optical sound recorder (left) and 16mm Magnetocord magnetic recorder and reproducer in duplex operation.

Fig. 49. Zeiss-Ikon background slide projector with 2000-w xenon lamp.

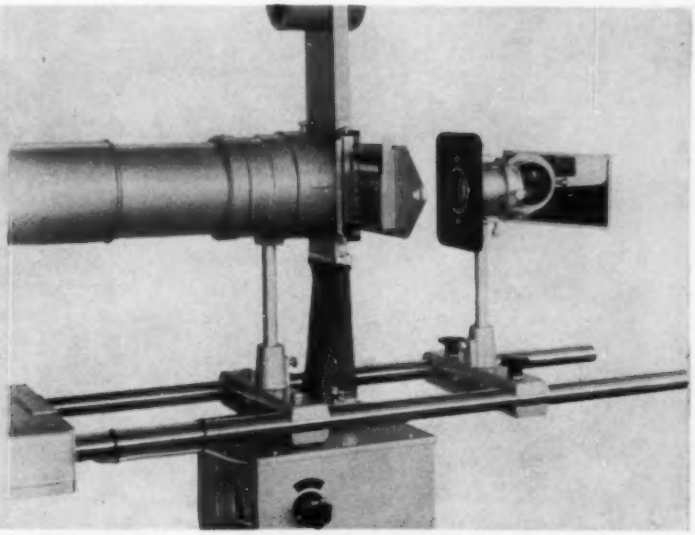

Fig. 50. Zeiss-Ikon background projector, showing mirror for "round the corner" projection.

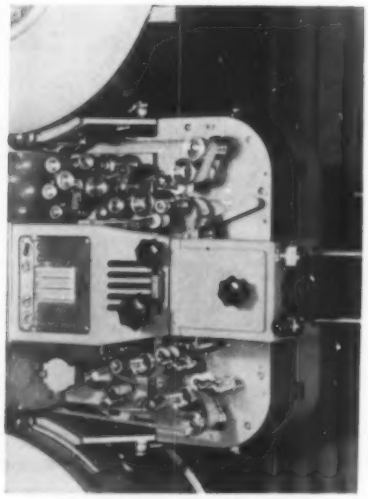

Fig. 51. Frieseke & Hoepfner universal projector for 35mm and 70mm films.

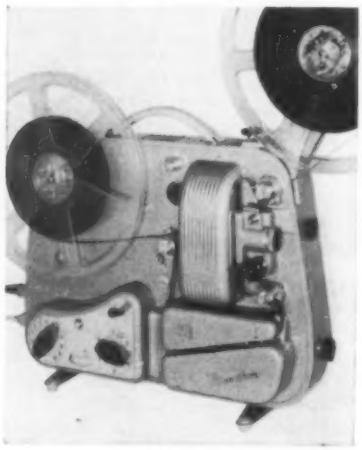

Fig. 52. Zeiss-Ikon 8mm projector for magnetic sound and striped prints.

equipment for screening 70mm Todd-AO films with 6-channel magnetic sound. In addition to the Bauer U2 Projector, described in the 1958 Progress Report, there is another German projector on the market, made by Frieseke & Hoepfner in Erlangen-Bruck, the FH-Universal Projector. It is constructed for 35mm and 70mm films with optical and four- or six-track magnetic sound. The high-efficiency lamp is designed for 150 amp and is equipped with a cold-light mirror. The curved film gate (Fig. 51) has steel-strip springs to achieve the correct film pressure. The film magazines have a capacity of 1600 m of 35mm film or 900 m of 70mm film.

An 8mm projector with magnetic sound for striped prints is the new Zeiss-Ikon Moviton (Fig. 52). The frequency response is claimed to be flat from 70 to 7000 cps at a speed of 16 frames/sec. It has a 50-w lamp that produces 90 lm and a lens P-Sonnar 1:1, 3 (f/20mm). An anamorphic lens can be adapted.

Great Britain

Cinematography

Taylor, Taylor and Hobson have produced a new zoom lens for image-orthicon cameras. It has a focal range of 2 to 40 in. and is therefore of very wide application. The firm has also produced, in collaboration with Evershed and Vignoles Ltd., the first servo-operated studio zoom lens which can be remotely controlled. Both sets of equipment were shown in April at the NAB Convention in Chicago.

E.M.I. Electronics Ltd. has announced a new image-orthicon CPS camera, Type 203 (Fig. 53) which is adaptable to any of three pickup tubes, 3-in. image-orthicon, 4½-in. image-orthicon or CPS-Emitron. A five-position turret has four lenses with servo-controlled aperture and the fifth position a diascope auto-

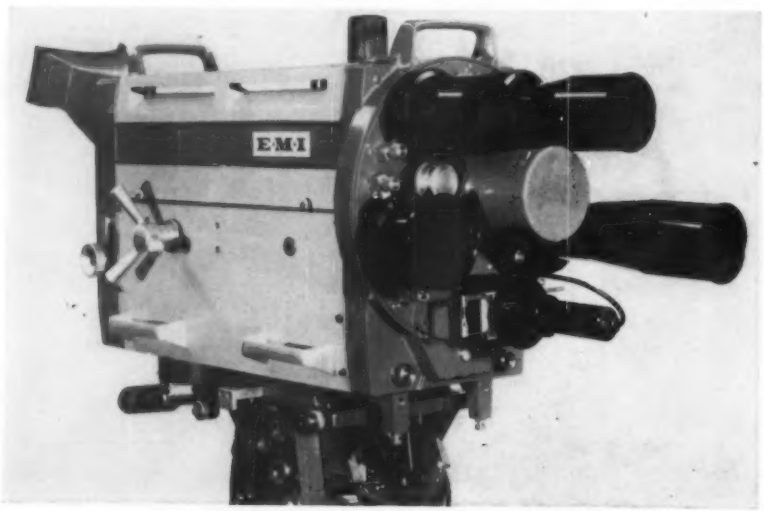

Fig. 53. Type 203 image-orthicon CPS camera (E.M.I. Electronics Ltd.).

Fig. 54. Automatic cuing device (Autocue Ltd.).

illuminated in the taking position. The control circuit contains adjustable gamma correction and aperture controls. This firm has also produced a color camera, Type 204, providing simultaneous color signals from three vidicons. Light efficiency is very high, each pickup tube having its own objective lens, with dichroic mirrors used for beam splitting.

Considerable development has taken place also in the commercial television field. Associated TeleVision, Ltd., for instance, has done considerable work in transistorizing distribution and video switching equipment. The firm has also produced a completely transistorized radio microphone in which the transmitter is frequency modulated and meets full broadcast quality standards. This company has also made a mobile recording unit for American 525-line standards.

Autocue Ltd. has produced a new very light automatic cuing device (Fig. 54) which can be fixed either to the front of the television camera or on a light tripod out of the viewing angle. A number of the devices can be synchronized if required. The script is typed on a jumbo-sized typewriter giving full visibility up to 20 ft using ½-in. type.

Last year Rank Precision Industries Ltd. introduced a sound adaptation using magnetic-striped film for the 16mm Arriflex Camera, and later produced a 16mm magnetic film recorder for synchronizing sound with the Arriflex. Known as the Gaumont-Kalee Type 1830 16mm Portable Magnetic Recorder it is synchronously driven, weighs only 30 lb and measures 15 by 14 by 8 in.[170]

W. Vinten Ltd. announced a number of new 16mm cameras for scientific work. The Scientific Camera Mark II (Fig. 55) for 50-ft and 200-ft lengths of double-perforated film has a mirror reflex shutter speed of 8, 16, and 24 frames/sec and single exposure with a 144° fixed shutter. A three-lens turret is provided and a 12-v d-c motor is

situated in the camera body. A later model of the 16mm Vinten camera is intended for high-speed work with speeds up to 250 frames/sec.

John Hadland and Co. produced a useful work study attachment. It is intended for micromotion study at framing rates from 2 frames/sec to 1 frame/2 sec. Remote and synchronizing controls are included and the drive to suit the camera is by a 240-v or 110-v a-c motor or by a 24-v d-c motor.

Pelling and Cross offer a time-lapse control unit in which the actuator is separate from the timer. Intervals of 1, 5, 10, 30, and 60 sec are provided for, as well as automatic switching of lights. It is intended for the 16mm Bolex camera.

In the laboratories there has been a considerable changeover to 2000-ft rolls of release print material. Figure 56 shows a typical conversion of a Bell & Howell Model E for 2000-ft rolls at the Rank Laboratory.

Technicolor has equipped its Harmondsworth plant for processing 70mm Eastman color positive and manufactures optical printers to make 70mm prints from Technirama original negative.

James A. Sinclair & Co. Ltd produces a new lightweight portable electric Newman Sinclair camera.[171] It is only 6½ lb in weight with register pin movement. The robust offset turret will take 18mm to zoom lenses.

A British Company, Joyce, Loebl & Co., manufactures the Joyce-Gevaert Recording Colour Densitometer. The instrument was developed and used in the Gevaert Laboratories and is now available generally. The instrument will record on a chart up to 90 three-color analyses per hour with an accuracy of 0.01 in density up to D = 3.5. The machine is calibrated in ASA diffuse densities and uses three pens, yellow, purple and blue-green, which are exchanged automatically. The density of the material to be measured is compared 50 times per second with the standard wedge, giving 1500 separate measurements per sample, so that all possibility of error over the range is virtually excluded. The instrument is also available as a black-and-white equipment.

Film

Ektachrome Commercial Film, Type 7255, was introduced in this country at the beginning of the year, and the improved Kodachrome film for Duplicate Printing, Type 5269, was introduced in the late summer. These two films in combination have proved popular with 16mm producers of documentaries and sponsored films. The processing of Ektachrome Commercial film is carried out by trade laboratories, and at the end of the year a service was being offered by four organizations, Rank Laboratories (Denham) Ltd., Colour Film Services Limited, Reeds Colour Film Laboratories and Kay Laboratories Ltd. Increased-speed Eastman Colour Negative Film, Type 5250, also became available towards the end of the year.

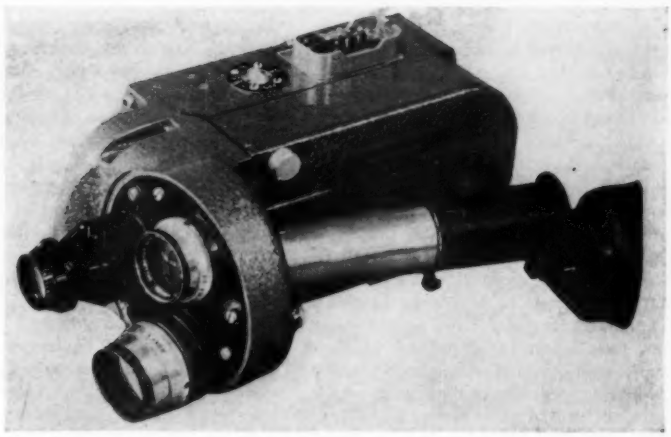

Fig. 55. Scientific Camera Mark II (W. Vinten Ltd.).

Gevaert Limited has marketed three new reversal 16mm films, two panchromatic films, Type 863 and Type 880, for camera use of 64 and 250 ASA; the first is of phenomenally fine grain. The third, Type 850, is a telerecording film, blue-sensitive only. The camera films are intended for television use giving a maximum density of 2.65 at a gamma of 1.30.

Reversal films have not been used hitherto in the United Kingdom, mainly because a really professional round-the-clock service has not been available. The Rank Laboratories (Denham) Ltd. have now installed a new large reversal processor and a rapid, day and night service has resulted in a marked increase in the use of reversal films for television.[172]

Television Coverage

During 1959 the population coverage was again increased and by the end of the year 98.5% of the United Kingdom population was within range of BBC's

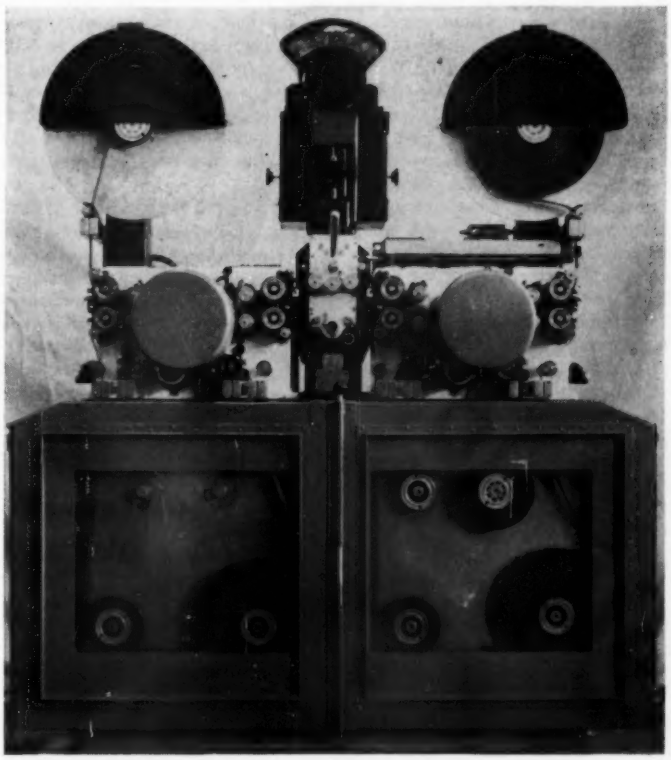

Fig. 56. Bell & Howell Model E converted to hold 2000-ft rolls of release print material.

television service. The increase in coverage was achieved by bringing into operation in October a new low-power station near Peterborough which serves an additional 150,000 people. Also the temporary television transmitting installation near Kirkwall in the Orkneys was replaced by the permanent installation during December thus increasing the coverage to more than 40,000 people in the Orkney Islands and the North of Scotland. The temporary transmitting station at Truleigh Hill near Brighton has now been replaced by a permanent new installation at Whitehawk Hill on the eastern outskirts of Brighton thereby improving reception in those parts which were not satisfactorily served from Truleigh Hill. The Whitehawk Hill equipment will operate unattended and is housed in a 10-ft square steel cubicle positioned below the four legs of the 150-ft aerial tower.

In June, the Postmaster General gave approval to the first stage of BBC's scheme to further increase the population coverage by the installation of low-power satellite television stations. Approval was given for 14 of these to be built in the first stage of the scheme which is expected to be completed by early 1962. These 14 stations will extend the coverage to a further 200,000 people, but in addition will provide an improved service for nearly one million people. The majority of these stations will be of the "translator" type, similar in principle to the television translator developed by the BBC that has been working successfully to serve the Folkestone area since July 1958. They will be designed to work unattended; each transmitter will pick up signals from an existing BBC station and retransmit them on a different channel for local reception. The actual power of each station will be determined by the size of the area to be covered and the nature of the country. Any further extension of the scheme to build low-power stations will be largely governed by considerations of co-channel interference. It should be remembered that in the early days of television development in the United Kingdom it was anticipated that no more than 10 or perhaps 12 stations could be operated in the five available channels in Bank I. At present there are 23 stations operating, excluding the 14 satellites referred to above.

TV Studios and Pickup

In London, work is proceeding on the new BBC Television Centre. The circular center block is now nearing completion[173] and many of the offices are already in use. The first of the seven large studios is scheduled to begin operation by the middle of 1960.

In the Regions the scope of the BBC's TV programs is being widened by the improvement of existing studios and the building of new ones. During the year new studios have been brought into operation at Newcastle, Belfast, Norwich and Manchester; their introduction will enable programs originated at these centers to be broadcast either by the regional transmitters only or by the whole BBC transmitter network.

New equipment has also been permanently installed in the two Cardiff studios and new TV switching centers brought into use in Birmingham and Glasgow.

A remotely-controlled TV camera developed by BBC engineers was introduced in September. The camera is located in a studio near Broadcasting House, London, but all its functions can be controlled from the Television News Studio at Alexandra Palace six miles away. At Alexandra Palace there is a control console from which, via cable circuits, the camera can be switched on, panned, tilted, focused, and zoomed as required. Alternatively, for interviewing, local control can be taken over by a "shot box" which is held in the hand of the interviewer in the studio. The shot box, connected to the camera equipment by trailing cable, has pushbuttons which enable selection to be made of any one of four predetermined adjustments of pan, tilt, focus and zoom.

Although zoom lenses have been in use for some years for television outside broadcasts by the BBC it was not until this year that they were introduced into studio operations. Definite scope has been found for zoom lenses in studios, not only for actual zooming during transmissions but also because of their ability to provide an infinite number of viewing angles within the limits of the particular lens used.

Telerecording and Film Processing

A "full-information" 35mm film telerecording channel was brought into use in June. This equipment has a pulldown period of about 5 msec; the field blanking period in the British television system is 1.4 msec so that the camera is shuttered during the first few active lines of each field. The information contained in these lines is stored by using a sufficiently long persistence phosphor on the display tube. A graded gray filter in front of the display tube enables a uniform effective exposure to be obtained.

There has been a steady increase during the year in video-tape recording using Ampex equipment.

To meet the needs of regional and subregional centers where the film output is not more than 2000 ft a day, a very small 16mm processing machine has been developed and produced by a commercial undertaking in conjunction with the BBC. It will continuously develop, fix, wash and dry any length of film up to a maximum of 400 ft. The overall dimensions of the equipment are only 21 in. long, 21 in. wide and 48 in. in height. The speed of the machine is continuously variable between 2 ft and 12 ft/min but for average negative material 100 ft of film can be processed in 28 min. by the use of a special preloading magazine permanently attached to the machine. Films of 100 ft or less delivered in daylight loading spools may be fed into the machine without the use of a darkroom. Films up to 400 ft in length and supplied on conventional 2-in. plastic cores are first loaded in a darkroom onto a special split spool having solid light-tight side flanges.

Cablefilm

Although transmission of live television programs across the Atlantic has not yet been achieved, a new method of sending 16mm film pictures between Great Britain and North America was introduced in June of this year. The system was developed by BBC engineers and the trials using the transatlantic telephone cable were carried out with the valuable cooperation of the American Telephone and Telegraph Co., the Canadian Overseas Telecommunications Corp. and the British Post Office. The necessary bandwidth economy is achieved by restricting both the vertical and horizontal deffnition and by reducing the transmission rate. Only 200 scanning lines are used and every alternate film frame is scanned. (At the receiving end each frame is reproduced twice.) Twenty-five lines/sec are transmitted so that each frame takes eight seconds to complete. The maximum video frequency is only 4.5 kc and the signal is transmitted in the form of a vestigial sideband signal on a 5-kc carrier, the bandwidth of the transmitted signal extending from 0.5 kc to 5.5 kc. The signal is transmitted across the Atlantic in the "in-band" music circuit of the transatlantic telephone cable. A 30-sec film sequence is transmitted so that for short news items there is a great saving in time compared with flying the film across the Atlantic. Signal-to-noise ratio is maintained at a satisfactory value in the absence of the volume range compressors and expanders by modulating to a depth much in excess of 100%. The "excess" modulation envelope is folded back and synchronous detection used at the receiving end. Picture quality is remarkably good considering the bandwidth limitations.[174]

Standards Conversion

The Post Office permanent cross-channel radio link has now replaced the BBC/RTF cross-channel vision link for Eurovision program exchanges. Standard sconversion equipment pioneered by the BBC [175] is still supplied and operated by the BBC at the new Post Office terminal at Tolsford Hill, near Folkestone.

Work has continued on equipment for conversion between British and American television standards. This is more difficult than conversion between the various European standards because of the difference in the field frequency which tends to produce a 10-cps flicker. It is hoped that this equipment used in conjunction with video-tape recorders at transatlantic airports will provide a useful alternative route for items too long for transmission by the Cablefilm system.

The BBC made available to NBC at London Airport video-tape recordings at the American standard of program material transmitted from Paris during the Western Summit Conference held there during December. The BBC's new standards conversion equipment, in conjunction with a chain of super-high-frequency radio links, was used for this project and the programs were thereby made available to the American viewing public in the shortest possible time, the only delay being the time for the transatlantic flight.

Television Waveform

In April the BBC television waveform was modified by the omission of the "pedestal" between the 30% and 35% levels of the composite video signal amplitude which formerly separated the picture information from the synchronizing signals. The pedestal was introduced in 1954; among other functions it was intended to provide a margin between picture and synchronizing signals which would render harmless any overshoots generated in the originating and transmission network and help to eliminate receiver fly-back lines. Developments since 1954 have made the pedestal unnecessary and in fact its presence had been found to have operational disadvantages. The range of amplitudes containing the picture information varies according to the contrast ratio; for example, for scenes where the ratio lies between 100:1 and 60:1 with peak white set at 100%, the level corresponding to the darkest parts of the picture lies between 37% and 39% of the composite video signal amplitude, while for scenes with small, very dark areas the minimum picture signal level is allowed to fall to 32%, but not less, except for special effects. The synchronizing signal continues to occupy the range from 0 to 30% of the maximum composite signal amplitude.

Iran

About twenty years ago, the first Persian films produced were made, not in Iran but in India. They consisted of a series of four films on national stories. About ten years ago Iran started to produce theatrical motion-picture films for showing only within the country. The first films produced in Iran were weak technically and could not compete with foreign films, but because the Iranian audience had never seen feature films in their own language, the films were well received. As a result more people were encouraged to invest their money in this business. The films produced now have improved technically but still are produced on a minimum budget as the only market for them is within the country.

As the making of feature films became a good business financially, movie studios increased in number until by 1955 there were some 35 studios in Tehran, producing films in the Persian language. However, the dubbing of foreign films, especially those from Europe, opened a new era in the motion-picture industry of Iran in 1956. Because the foreign films were superior to those locally produced from technical and artistic points of view, the public preferred them to Iranian films, and, as the cost of dubbing was so low, more studios began dubbing; a great number of the smaller studios went out of business.

Currently in Tehran (the center of the Iranian motion-picture industry) are about eleven major studios and some smaller ones; most of them are busy dubbing foreign films into Persian and some are producing theatrical films on a small scale. These studios are briefly described below:

The Audio-Visual Center, Fine Arts Department, opposite Majlis, Tehran, is a government organization, set up by Iranian and American funds (the American funds through ICA); it has completely up-to-date equipment manufactured in the United States and in Germany, and can handle 16mm and 35mm black-and-white and color productions. Present output is two newsreels a week and some documentary films every year for the government.

Iran Film Studio, Avenue Semnan, Avenue Bahar, Tehran, is equipped to produce and dub films and at present is mainly engaged in dubbing. The equipment is 35mm, mostly German, with some locally made.

Badie Film Studio, No. 843 Avenue Shah Reza, Tehran, is equipped to produce and dub films and is mostly engaged in dubbing. It has 35mm and 16mm equipment, mostly German and American with some locally made and is equipped only for production in black-and-white.

Central Studio, Avenue Shah Reza, Tehran, is equipped to do dubbing work primarily, but can take on productions too. As the owner is agent for almost all German motion-picture production equipment, the studio is equipped with the latest German equipment in 35mm and 16mm black-and-white.

Studio Misaghieh, Koutche Iraj, Avenue Qavan Sultaneh, Tehran, is equipped to produce and dub films; the equipment is mostly German with some locally made (35mm black-and-white).

Studio Asre Talaie, Avenue Fisherebad, Tehran, is equipped to produce and dub films in 35mm black-and-white. The equipment is locally made, with the exception of some Italian equipment.

Studio Pars Film, Karadj Road, Tehran, is equipped to produce and dub film. The equipment is of German and Italian manufacture and some is locally made (35mm black-and-white).

Studio Karavan Film, Avenue Lalezar, Tehran, is equipped to produce and dub films in 35mm black-and-white. The equipment is locally made with the exception of some equipment of German manufacture (35mm black-and-white).

Studio Shahab, Avenue Hedayat, Tehran, is equipped for dubbing only. The equipment is locally made.

Cinema Moulan Rouge Studio, c/o Cinema Moulan Rouge, Avenue Shimran, Tehran, is equipped to do magnetic dubbing only. It has German and locally made equipment. One of its operations is to dub films for use in Cinema Moulan Rouge.

Cinema Plaza Studio, c/o Cinema Plaza, Avenue Shah Reza, Tehran, is equipped to do magnetic dubbing only. It has German and locally made equipment and dubs films for use in Cinema Plaza.

These studios and some other small ones have been primarily occupied during the past year with dubbing foreign films for 214 cinemas within the country (there are 61 cinemas in Tehran, the capital city of Iran, and 153 cinemas in the provincial towns of Iran). Also during 1959 some 25 feature films have been produced by these studios, mostly on a limited budget due to the narrow market for their showing as well as to the competition of dubbed foreign films.

It should be mentioned here that in Italy there are a few Irano-Italian companies which dub Italian films in the Persian language for showing in Iran. Such films are usually very popular and the dubbing job is good.

Among the locally produced films released in 1959 was *Party in Hell*, which was a boxoffice hit and was artistically and technically better than previous Persian films. The producer entered this film in the Cannes Festival last spring but did not win a prize. The film was produced by Misaghieh Studio.

Amateur Camera Equipment. Amateur camera equipment such as 8mm and 16mm cameras is available; however, only a few of the rich own 8mm movie cameras and even fewer own 16mm equipment. Both 16mm and 8mm color and black-and-white films are available for those who can afford this ex-

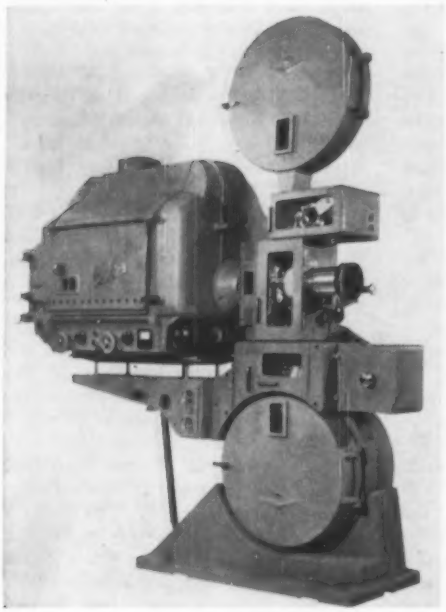

Fig. 57. Phirex Crown 70 (Nippon Onkyo Seiki).

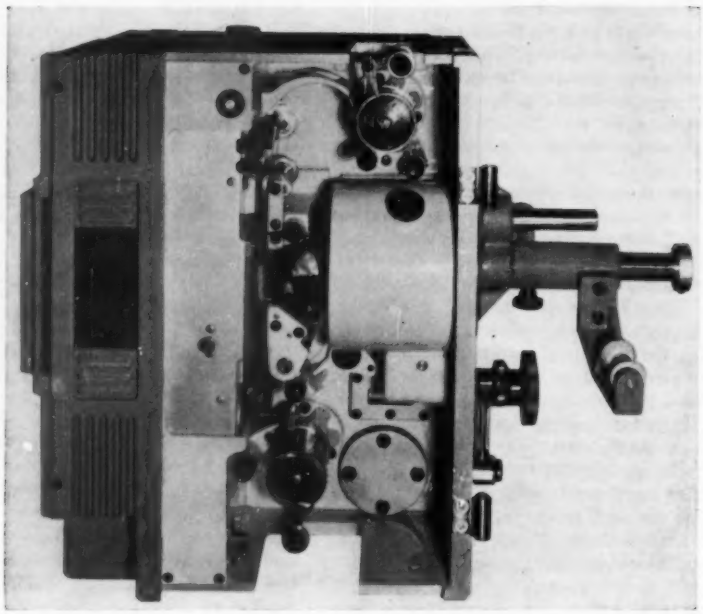

Fig. 58. Phirex Crown NA4-35/70 projector mechanism.

pensive hobby. Arriflex 35mm camera equipment is also sold in Tehran, but other 35mm camera equipment is not available.

Television in Iran. A privately owned TV station, belonging to H. Sabet, came into existence last year, operating only in Tehran. Later a branch of this station was opened in Abadan (in the south of Iran). The Tehran station is on the air daily from 6 P.M. to 11 P.M. Its programs are mostly live shows with very few films and advertisements help finance the station.

On December 24, 1959, an American armed forces TV station opened in Tehran which transmits programs for the particular benefit of the American armed forces and their families, as well as other Americans in Tehran. The station is on the air from 5 P.M. to 11 P.M.

Italy

For the second year our reporter in Italy has not submitted a report. We are sure there is a lot of activity, especially in the motion-picture field and we hope that next year a full report will be coming.

Italy's second TV network to be operated on a commercial basis was set for launching in April 1960.[176]

Japan

During 1959 production of film releases and equipment continued to advance, although at a slower rate than during preceding years.

A noteworthy development was the successful launching of 70mm roadshow productions at the end of October, followed by such public response at the boxoffice that a revival of the slumping equipment business ensued. Reawakened interest on the part of exhibitors in neighboring Asiatic countries, for whom Japan provides a common market source, indicates a healthy trend in the motion-picture industry.

The xenon discharge lamp as a projection illumination source is widely used, in preference to the carbon arc, in medium-sized and small 35mm theaters as well as for 16mm applications. Overall, 1959 was not Japan's best year in terms of new product developments, but nevertheless some solid gains were made.

70mm and 35mm Exhibition Equipment

In the 70mm field, the Phirex Crown 70 system (Fig. 57) was a noteworthy development. Although newly designed throughout, the NA4-35/70 projector head retains certain features of the 35mm Super Phirex introduced during 1958 by Nippon Onkyo Seiki Co. of Osaka. The Crown mechanism (Fig. 58) is fully encased with individual compartments for the film path; shutter assembly; drive train and intermittent movement, the latter being sealed and self-lubricated. Film gate cooling is achieved by a combination of forced water circulation through the jacket tubing surrounding the trap plus pulsed air jets directed against the film aperture. A double-speed single-blade conical shutter is used to provide maximum light transmission with a minimum of flicker. The prime lens (4-in. in diameter) is accommodated in a sturdy mounting with a support stud for the secure addition of anamorphic attachment. The

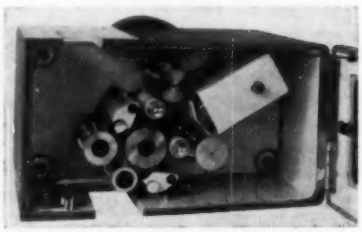

Fig. 59. Phirex Crown NL-7040 tight-loop drive magnetic soundhead.

provision of a synchronized safety fire shutter with film-rupture trip-switch controlling automatic cutoff of the drive motor affords optimum protection of both film and mechanism against break jamming. Curved gates and traps, and sprockets and pads may be interchanged for adaptation to either 70mm or 35mm with a choice of running speed at either 30 or 24 frames/sec.

Film magazine dimensions are large enough to accommodate interchangeable mounting of either 70mm or 35mm film reels for any projection process from Todd-AO and Panavision-70 through CinemaScope to conventional 35mm in any chosen wide-screen image aspect ratio.

The NL-7040 magnetic soundhead (Fig. 59) employs a flutter-free tight-loop drive design and similarly converts for 70mm or 35mm operation by simple interchange of sprockets and rollers, with a choice of six- or four-track magnetic head assemblies. A complementary optical soundhead provides versatility in film sound reproduction by various processes. The unit is supported upon a massive pedestal affording rock-steady

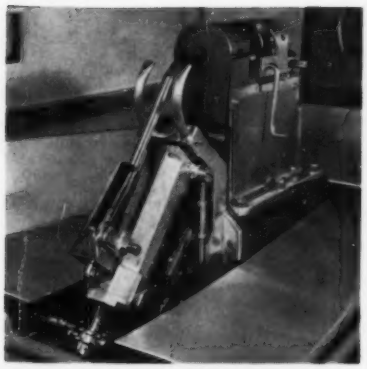

Fig. 60. Positive and negative head assemblies of Hi-Phirex 200 high-intensity arc lamp.

projection on any chosen axis between included angles of 5° above to 18° below horizontal. The pedestal lamp table is dimensioned to mount a rotating positive high-intensity lamp fitted with a 21-in., diameter $f/1.6$ reflector such as the Hi-Phirex 200, also of a new design coordinated for employment with the Crown equipment.

Illumination output up to a maximum of 55,000 lm through the 70mm aperture is claimed for the Hi-Phirex 200 arc lamp. Its design includes twin tube air jets directed against both sides of the arc tail flame, air supply for both this function and forced cooling of the lamphouse coming from individual sirocco blowers coupled to individual positive and negative feed motors controlled by a balancing automatic carbon feed system (Fig. 60). Normal lamp operation is at 180-amp, employing new Kadomax 13.6mm by 510mm positive, and 11mm by 235mm negative carbon trim developed especially for this lamp by the firm of Matsushita Electric Industrial Co. Ltd. Similarly, a new custom design of SanRex selenium arc rectifier delivering up to 200 amp maximum was developed by Sansha Electric Mfg. Co. Ltd. of Osaka.

The Crown six-channel stereophonic sound system is provided in building-block form with two- or three-rack mounted amplifier and power supply panel assemblies. Performance is geared to specifications for Todd-AO six-track reproduction, and it is designed to provide flexibility of control to serve the five two-way stage reproducers behind screen plus any required number of surrounding speakers suitable for road-show houses.

Nippon Onkyo also introduced the Crystal Crown lenticulated screen, with carefully controlled crystalline reflective coating and seamless appearance designed to reflect images semidiffusively with uniform high brilliance and clarity, and with total absence of color distortion in evenly concentrated distribution throughout useful audience seating areas.

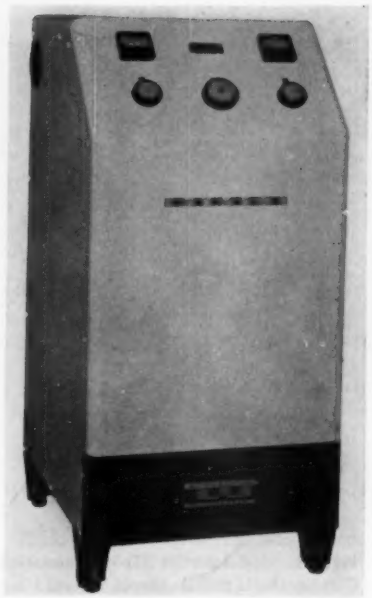

Fig. 61. SanRex SRH-12-200 selenium arc rectifier (Sansha).

During the first quarter of 1959, the same company successfully premiered its Xelight xenon projection lamp designed as a companion to the 2-kw model introduced in 1958. Design concept is similar for both lamphouse models. A total of 45 pairs of lamps (of both input power ratings) were installed during the year.

An all-new design series of highly corrected prime lenses for 70mm film projection under the Super-Prominar label was developed by Kowa Optical Co. to achieve uniformly sharp image resolution on the largest screens of deepest practical curvature mounting. Despite suffering grievous major destruction of their Gamagori plant during Japan's cataclysmic disaster of the late September typhoon, Kowa completed initial production to enable simultaneous premiere showing on October 31, 1959, of *South Pacific* in both Tokyo and Osaka on the first two Phirex Crown 70 installations. A complete design range is available in focal lengths between 2 and 6 in., the majority of $f/2.0$ speed. Typical of this line is the 50mm (2-in.) corrected anastigmat, mounting 8 lens groups of 11 coated elements within a barrel of 288.5mm (7.3 in.) overall length and major diameter of 136mm (3.7 in.) providing back focus spacing from the aperture of 75.3mm (1.9 in.).

Sansha Electric Mfg. Co. Ltd. of Osaka completed a new research and development laboratory and executive office building early in November and at that time announced the new "SanRex SRH-12-200" selenium projection arc rectifier developed concurrently and initially to power the Hi-Phirex 200

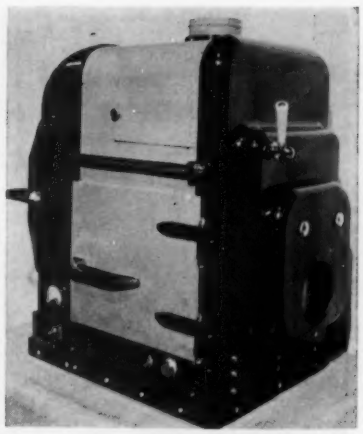

Fig. 62. HX-2000 lamphouse accommodates 4-kw xenon lamps. Jointly designed by Hiraoka, Toshiba, and Tokyo Theatre Supply Companies.

lamps. Incorporating Sansha design circuitry, further advances in refinement of operating features have been made in this new high-output rectifier (Fig. 61). Operating from 200-/250-v 3-phase line source, the SanRex SRH- series utilizes six-phase full-wave rectification with stepless smooth control of output through d-c saturable reactors in each secondary leg. Novel features introduced in the SRH-12-200 model include push-button control to reduce short-circuit current at the moment of arc-strike ignition to below one-half of the maximum 200-amp output rating to prevent initial carbon core detonation and crater deformation and virtually eliminate glass reflector surface pitting caused by impinging carbon particles and copper slag droplets. Selective voltage monitoring of each incoming phase line is provided to detect imbalances not uncommonly encountered in Asiatic power service. Sansha has expanded its product lines for general industrial applications to include germanium and silicon rectifiers. However, dependability and uniformity of production control quality factors have proven unsurpassed in selenium rectification for carbon arc supply so that utilization of other semiconductor elements involving higher costs for projection applications presently appears unwarranted.

Reports of other developments in the 35mm exhibition field were static for the year with the single exception of the third Japanese 35mm xenon projection arc lamp which was introduced in two models; the deluxe Hi-Central HX-2000 with mounting acceptance for xenon discharge lamps rated at 2-, 3- or 4-kw input (Fig. 62) and the smaller HCX-2 for 2-kw input xenon lamps only. These products were jointly designed and manufactured by Hiraoka Kogyosho Co. Ltd., Tokyo Shibaura Electric Manufacturing Co. Ltd. (Tosh-

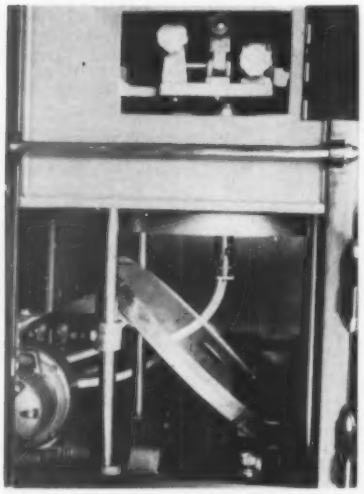

Fig. 63. Internal view of HX-2000 xenon projection lamp showing design of lamp suspension and reflectors.

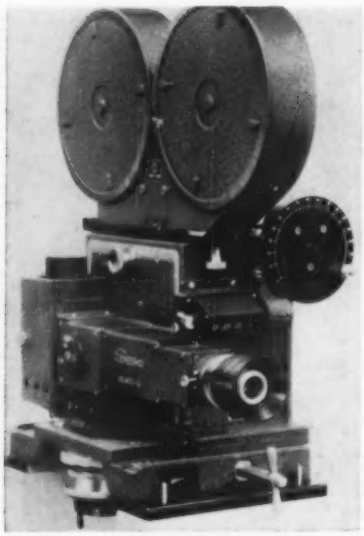

Fig. 64. Model SAC-2 35mm Animation Camera (Seiki Seisakusho of Tokyo).

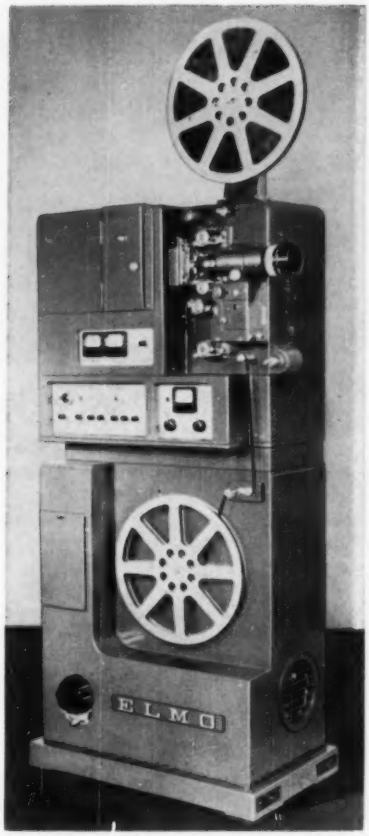

Fig. 65. Elmo Model 16-TV projector for vidicon camera pickup.

iba), and Tokyo Theatre Supply Co. Ltd., with special reflectors by Yamada Kogaku Kogyo. More than a year under intensive development, the Toshiba series of xenon discharge lamps are designed with excitation voltage requirements reduced as much as 22% by means of a relatively simple modification of conventional arc rectifier supplies. A special circuit design enables direct coupling to automatic projection control systems.

The 2-kw Toshiba xenon lamp operates at 25-v, d-c and 80 amp. It is mounted in the HCX-2 lamp in vertical axis with a small spherical collecting reflector and an elliptical main reflector. Total projected light through a conventional running 35mm projector (Fuji Central F-7) with 47° shutter opening fitted with standard 0.600 by 0.825-in. aperture plate was measured at 4200 lm at 6,100 K. Comparable data for the higher 3- and 4-kw input lamps were not made available for this report. It is claimed that because of the special reflector design, the operating assembly can be mounted within a modified arc lamphouse and, in fact, the HCX-2 housing is essentially the same as Hiraoka's HC-14A carbon arc lamphouse. The HX-2000 has a completely new design to accommodate the larger input lamps in unconventional configuration (Fig. 63). XL-2000 xenon lamps presently are guaranteed for 600-hr life by Toshiba, the largest among several giant electrical manufacturing complexes of the Orient.

Also introduced during 1959 was the model M-6 portable incandescent 35mm sound projector by Tokyo's Shinkyo Electric Industrial Co. Ltd. Essential features largely duplicate those earlier developed in special models for applications by the military forces. Whereas the American market demand for these appears nearly to have vanished, 35mm portable projectors still find popular demand throughout Japan and other Asian nations both for educational applications and for itinerant entertainment exhibition in rural communities having no permanently established entertainment theater facilities.

35mm Production Equipment

The only new item reported is the Seiki 35mm animation camera, model SAC-2, designed for horizontal mounting upon elevator carriages of such animation stands as the SA-III (described in 1958 Progress Report, May 1959 *Journal*, p. 318) by Seiki Seisakusho of Tokyo. It is apparent that convenience for the animation cameraman was kept foremost in this design which has viewfinder eyepiece, shutter opening control, lateral rack handle and footage counter (metric system) all facing normal eye-levels while camera and finder objective lens systems scan downward on vertical axis facing the layout table below (Fig. 64). Added features include a double exposure shutter for special animation technique, and an incorporated slide projector imaging an illuminated sectional graph pattern to the layout board for ready charting of the camera exposure field without visual resort to the viewfinder.

16mm Equipment

The rapidly expanding Asian market potential for educational and cultural 16mm films is augmented with demands for 16mm television (kinescope) projection equipment. Thus it is not surprising that three principal manufacturers of this equipment have responded during 1959 with the introduction of important new product designs.

From Elmo Company of Nagoya came their model TV-16 xenon arc projector for vidicon cameras. Incidentally, the name Elmo derives from first letters of four inseparable integrals of complete motion-picture mechanisms: *E*lectricity, *L*ight, *M*achine, and auditory *O*rganism. This Company which, in 1957, produced a 500-w input xenon discharge source, now employs in the TV-16 assembly a 300-w compact xenon lamp supplemented (to insure operational continuity at all times) with an emergency back-up incandescent projection lamp compensated by a special filter. Film in the aperture is claw-advanced by the 2-3 pulldown system with image projection impinging on the vidicon camera tube through approximately 50% of each TV scanning field. Reproduction is from either magnetic or optical tracks with selective compensation and amplification output at +4dbm to the audio transmitting channel. All equipment including ignition starting and operating supply for the xenon lamp is self-contained in the pedestal-mounted unit 6 ft high, 2 ft 2 in. deep, and 1 ft 4 in. wide (Fig. 65).

Hokushin Electric Works Ltd. of Tokyo produced a number of 16mm specialty projectors, among them the

Fig. 66. New Hokushin 16mm Screen Process Projector.

Screen Process projector, useful both for direct projection to reflecting screens and for rear projection to translucent screens of 9 by 12-ft image size with brightness level achieved from a 1-kw input xenon lamp source. The operating assembly can be equipped for complete remote-control operation and is encased in a fully soundproof housing for studio use (Fig. 66).

Hokushin also introduced Model TC-3820 TV film projector having major improvements and added features superseding previous models. Particular emphasis was laid on accurate film movement registration in intermittent 2-3 pulldown action by rectangular pattern travel of its 3-finger stellite claw, the actuating mechanism of which is hermetically sealed and permanently lubricated. Optional features include a vernier adjustable speed control for use when the power source for the projector may not be synchronized otherwise with that serving the associated television transmitter; and automatic or manual control means of stepless change of light source compensating neutral density filters. Film magazine capacity for single-reel mounting of as much as 4000 ft of 16mm film is available. Sound takeoff from either magnetic or optical film tracks is provided as a standard feature.

Hokushin also introduced a semi-professional 16mm sound projector available either as model CX-14-10 (1-kw) or CX-14-5 (500-w), equipped with xenon lamp. This projector employs no shutter and the discharge lamp both starts and operates from a-c source through a compact ballast-starter. The intermittent movement and other parts are hermetically sealed with a force-lubricated oil bath. Oil-less bearings are used for other rotating parts. Three-finger claw advancement of film before the aperture affords accurate registration of successive frames.

Shinkyo Electric Industrial Co. Ltd. also aimed at the semi-professional market with the model SX-16 xenon-lamp-equipped sound projector (Fig. 67). The lamphouse is a scaled-down version of the Dojun Koki XK-35 King Light, which in the Shinkyo version, operates at 20-v, d-c and 50 amp supplied by the pedestal-housed selenium rectifier.

8mm Equipment

Elmo Company marketed an improved 1959 model 8-TV telecine projector for use by educational and other small TV stations where economy of initial capital investment and maintenance loom as prime factors (Fig. 68) as well as a complementary model 8-K kinescope recording camera. Both units operate at 15 frames/sec. The camera is fitted with a 16mm $f/2.3$ lens and records pictures off the picture tube at exposure rate of 1/30 sec. of two TV fields every other film frame. Normal magazine film capacity is 200 ft but an optional 400-ft double magazine is available. Sound facilities usually are not provided but the Elmo M-80 8mm magnetic stripe recording/reproducing attachment may be adapted for mounting on the projector to augment the projected picture. With this attachment, initially developed by Elmo and introduced in 1956, in conjunction with Elmo projector EM-80, the sound recording head is mounted at a point 58 frames advanced from the corresponding picture frame. Elmo also introduced two new 8mm silent projectors.

Otherwise, it appears that there were few developments in the 8mm field during 1959. Principal emphasis seems to have been placed on zoom-lens models by Canon, Yashica and others, as well as on built-in exposure meters. By the close of the year, no models had been introduced to meet competition of automatic exposure control for cameras, or automatic self-threading projectors now widely available in America and to lesser extent from West German sources. It is expected that during 1960 developmental activities in these areas will be expanded.

Television Network Expansion

Rapid expansion of 4000-mc broadband microwave radio network facilities continued throughout Japan during 1959. Additional microwave routes and

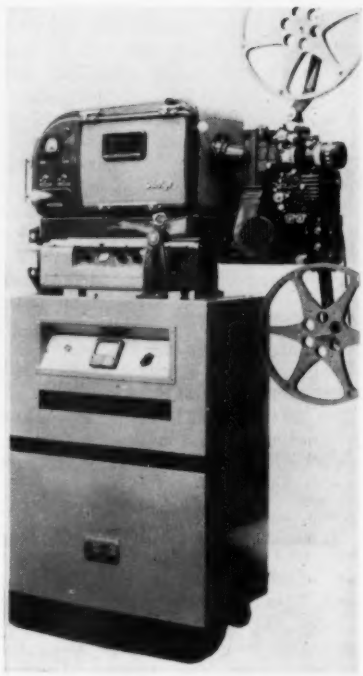

Fig. 67. Shinkyo Model SX-16 16mm sound projector.

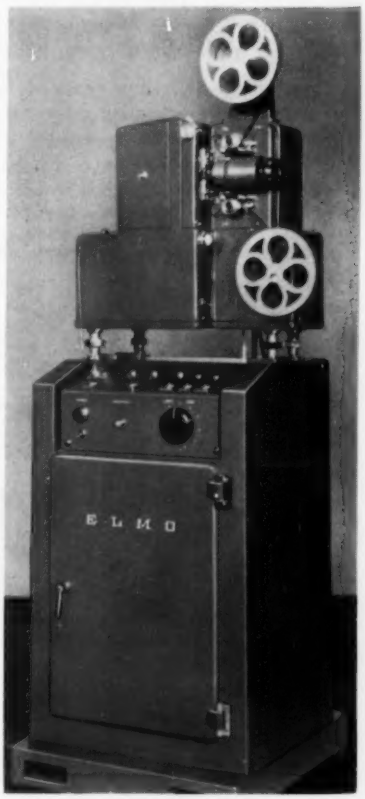

Fig. 68. Model 8-TV telecine projector adaptable to magnetic recording and reproduction (Elmo, of Nagoya).

branches were completed (Fig. 69) with more than 100 repeater stations now in service and many extensions and branches planned for early completion. At the end of the year there were about 24,100 channel miles (38,600 km) of broadband facilities in service and 6300 additional miles (10,100 km) in construction. About half of these facilities are for telephone and the rest for television transmission. Telephone circuits operating on these microwave routes total about 1¼ million miles (2,400,000 km). In addition to the 4000-mc microwave network layout, a 6000-mc type system is under construction between Tokyo and Osaka.

At the end of 1959, 45 commercial and 40 noncommercial television stations were in service and several other stations under construction. Twelve television VHF channel allocations and an FM band are under discussion in the Ministry of Postal Service. There are now six television stations (4 commercial and 2 noncommercial) in service in Tokyo. These stations also provide programs for other stations along the network route. The commercial television stations commonly use the network facilities and also provide certain private facilities of their own. Intracity and spur-route facilities are provided on paired and coaxial-type video cables and by means of short-haul microwave systems operating in the 6000-mc and 11,000-mc bands.

Three of the television stations in Tokyo are test-broadcasting color television and expect to be licensed by the Government during 1960.

Puerto Rico

This is the first Progress Report on Puerto Rico. For this reason some reference to earlier development is made at this time.

At present, equipments for television and motion-picture use are not produced on the island and no plans exist for the development of manufacturing operations. Other than in the manufacturing area there is considerable activity and a continuing healthy growth in television and motion pictures is clearly indicated.

The first Puerto Rican motion picture, *Tres Vidas en El Recuerdo*, was produced in 1955 by Rolando Barrera. In 1959 several pictures were produced, notable among them being *Maruja*, a truly typical Puerto Rican picture produced by Provo Films, a local independent production company.

Five years ago WKAQ-TV Telemundo set up its dubbing operations to dub filmed TV programs from the English language into Spanish for local consumption. Today this department has grown into a self-contained subsidiary company of El Mundo Enterprises and regularly puts out at least twelve such dubbed programs each week.

Fig. 69. Microwave relay systems in Japan.

In March, 1954, WKAQ-TV Channel 2 Telemundo made its first telecast in Puerto Rico. It was the first TV station to start operations. Today it leads TV in Puerto Rico both in live broadcasts and filmed shows. That first broadcast marked the beginning of what is today almost complete coverage of the island with a network of three stations. In the San Juan area viewers now have the choice of Channel 2, 4 or 6. During this period of development the number of TV sets on the island has increased steadily to its present total of 206,425.

Motion-picture theaters exhibit films from many countries, including the latest releases from Hollywood, in theaters in cities and towns throughout the island. Two large drive-in theaters in the San Juan area benefit from excellent year-round conditions for outdoor shows.

The government of the Commonwealth, or Free Associated State as translated from the Spanish, operates its own TV station and Film Production unit and its program of tax exemption coupled with financial assistance to new industries is doing much to promote the growth of all types of industry including TV and film production.

New companies for film production and television broadcasting were established in 1959. Much of this activity has been made possible by the Economic Development Program whereby owners of new industries coming to the island obtain tax exemption for a ten-year period subject to the fulfilling of certain requirements established by law. The Commonwealth Government, operating freely and independently of Federal control, has been encouraging new industries to come to Puerto Rico by offering the tax exemption and, in many cases, financial help and the use of buildings. Because no Federal taxes are involved, this encouragement is considerable. Companies operate within the territorial boundaries of the United States and are subject to all Federal import and export regulations but they pay all other taxes to the Puerto Rican Government. Goods pass freely between the continental United States and Puerto Rico. With insular tax exemption, machinery, materials, and equipment of all kinds may be imported freely from the continental United States and finished products are admitted to the United States as American produced goods without import duty. The effect on the motion-picture and television industries has been somewhat slow to appear but with the passage by the local government of specific regulations in 1959 in a tax exemption law covering the motion-picture industry, several companies have started operations or have declared intentions to do so. At present there are several independent producers. Two newsreel producers, Cine Productions and Vigue Films, also produce documentary films and film commercials for TV, and a government film unit and a dubbing and recording studio make Spanish-language soundtracks for many of the best known television filmed series seen in the United States.

Development during the last year saw finalization of plans for the construction by El Mundo of a new multimillion dollar building situated in the San Juan area and designed to house a newspaper, AM and FM radio stations, television studios and dubbing and film production facilities capable of handling the dubbing

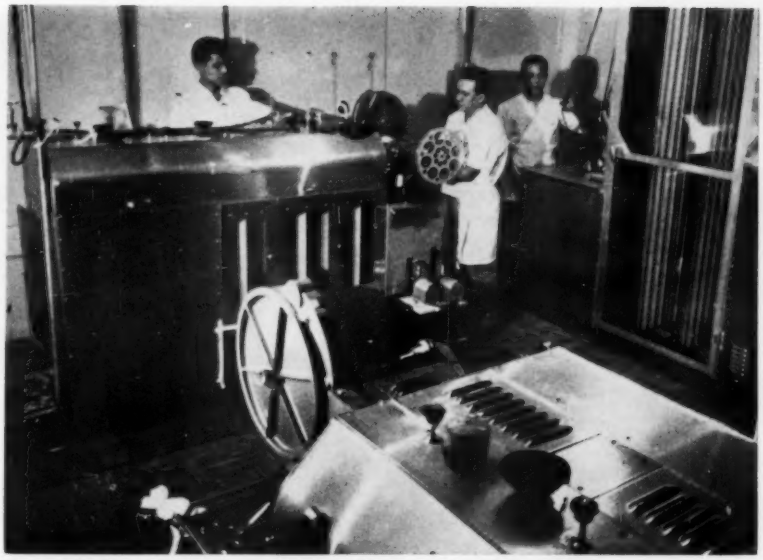

Fig. 70. Black-and-white processing machines used by Vigue Films.

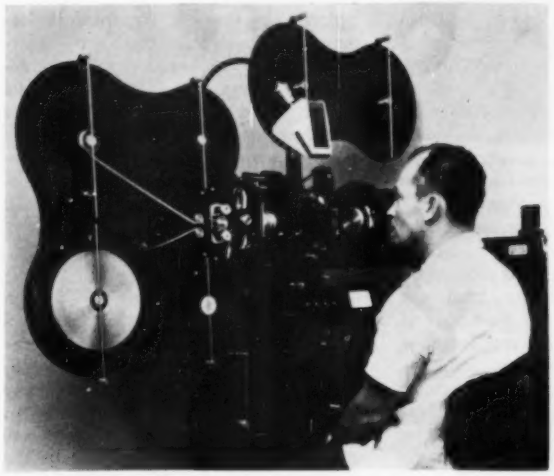

Fig. 71. Optical reduction step printer, Vigue Films.

Fig. 72. Continuous printer in operation printing picture negative and soundtrack negative on a single length of film (Vigue Films).

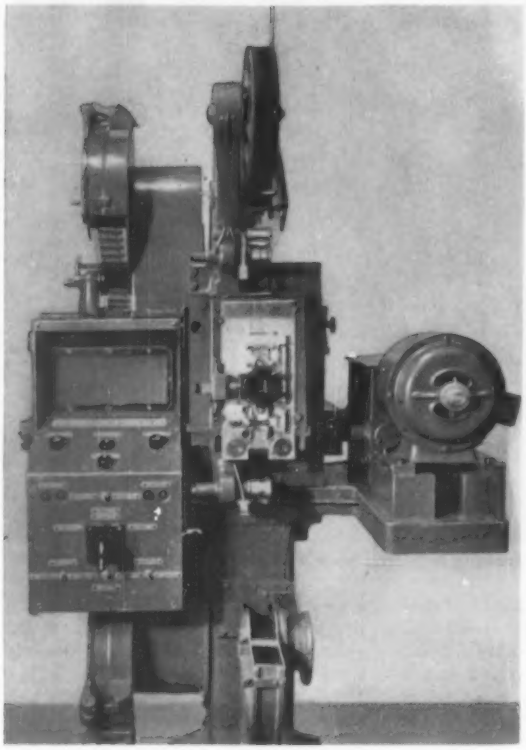

Fig. 73. Optical printer for printing 35mm dupes from 70mm negative.

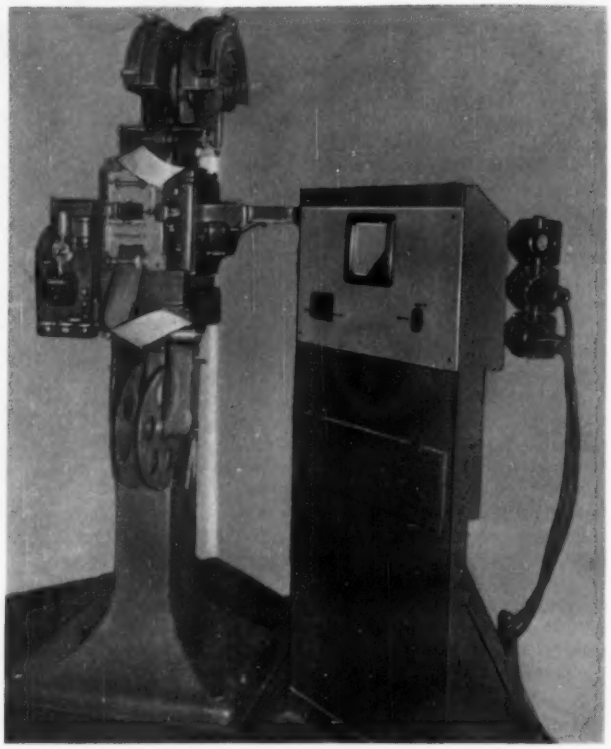

Fig. 74. Step contact printer for 70mm color film.

into Spanish of 40 half-hour programs a week in addition to providing complete facilities for motion-picture feature production. Construction is underway and completion of the main studios and production facilities is expected by the end of 1961.

In addition to El Mundo Enterprises' big expansion program, two major motion-picture production studios are slated for development during the coming months. One of these, Lester Cowan Productions, plans to build studios at the eastern end of the island near Fajardo and the second, owned by Hal Roach, has plans for converting a huge hangar at the Old Airport in San Juan into studios for the production of films and TV series production.

There are no independent film processing laboratories operating in Puerto Rico but the gap is filled by individually-owned processing installations capable of handling both 35mm and 16mm negatives and printing. Representative of such installations is the laboratory associated with the film and dubbing operations of the El Mundo Enterprises. This laboratory is at present equipped to handle all types of 16mm processing, animation, reduction printing, release printing, duplicating and titling, all in black-and-white. In addition 35mm negative and positive can be handled but facilities do not provide for printing in 35mm. This laboratory will be considerably expanded during the coming months and will eventually be able to handle all film production work in both 35mm and 16mm. At present it handles in excess of 150,000 feet of film per week. Vigue Films has full facilities for 35mm black-and-white processing (Figs. 70–72).

The story behind the development of the dubbing operations is interesting in that the methods used are unique on this side of the Atlantic. As far back as the pre-World War II years, Dr. Fred Kaufman, while in Europe, had invented a system for dubbing or post-synchronizing and five years ago he was brought to Puerto Rico to set up his system and apply it to the production of foreign-language soundtracks for television film series.

(This process is described in detail in the paper, "Dubbing in Puerto Rico," beginning on p. 346 of this issue of the *Journal*.)

As demands for the dubbed product increased, more distributors from the States moved into the market and dubbing became a new and lucrative part of the motion-picture industry. The production of Spanish-language versions became commonplace in Mexico, Cuba and Spain. Demands for more and more production were made to supply the South American television markets with acceptable program material. Competition became keen and standards as well as production rose. Today, in one dubbing operation in Puerto Rico alone, no less than 12 half-hour TV films are dubbed into Spanish each week. In 1960 this output will increase to close to 20 and by 1962 it is expected to reach 40. Methods have already been developed for applying the dubbing process to video-tape recorded material.

With the exception of a few key personnel, all the technicians working in Puerto Rico are local people specially trained "on the job" for the functions they perform. Previous experience in any of the multiple techniques of the motion-picture industry did not exist and it is a tribute to their keenness and endeavor that they have learned so much and are rapidly moving toward the point where the quality of their work can compete with any produced outside this small island.

Sweden

Six motion-picture theaters in Sweden have been equipped with Todd-AO installations. A typical installation in the theater Nya Ritz features an Aga amplifier center with 12 magnetic preamplifiers for two six-channel sound circuits. An optical sound channel and a separate channel for the entrance hall of the theater are included. The sound center is remotely controlled from the booth for either six channels or four channels (CinemaScope sound). The projectors

are Philips 70/35mm equipped with Mole-Richardson Super Seventy carbon arc lamps with water- and forced-air-cooled rotating carbons. The screen is 45 ft wide.

Modified optical units for the Hazeltine-Aga Electronic Color Film Analyzer (produced jointly by Hazeltine Research Corp., Little Neck, N.Y., and Aga Svenska AB Gasaccumulator), Stockholm-Lidingö, Sweden) were designed to accept, in addition to 16mm and 35mm film, 70mm film and still-picture negatives up to 8 by 10-in., the larger formats being scanned section by section. An earlier model of the color film analyzer was described in a paper published in the *Journal*.[177]

U.S.S.R.

The general state of cinematography in the Soviet Union throughout 1959 was characterized by increased film production, construction of a number of theaters in different areas of the country, the reconstruction of many studios by adding new stages and other production services, and development of new motion-picture equipment. A total of 139 full-length pictures (including 110 features) and 750 documentaries, popular science and educational films were produced; and the number of newsreels exceeded 1400 issues throughout the country.

During 1959, 11,000 projection units were put into operation, bringing the total to about 89,000. Cinema attendance for the year reached the 3.55 billion mark. The laboratories turned out 506.8 million meters of film prints including 140.8 million meters of color films.

Wide-Screen Cinema and 70mm

In 1959 a number of wide-screen installations were equipped with anamorphic optics. All wide-screen theaters are equipped with stereophonic sound systems using four-channel magnetic soundtracks. Noteworthy among the newly opened wide-screen theaters is the Udarnik of Moscow which seats 1600 persons. It has a metallized screen about 20 m (66 ft) wide with a brightness factor of 1.3 and 100° angle of vision.

In 1959 much was done to develop a motion-picture system using 70mm film. Used in cinemas equipped with 70mm film projection and multichannel sound reproduction apparatus, this system is expected to give perfect presentation with the "participation effect." At the same time, it is expected to improve the quality of prints of the same films with conventional and anamorphic image on 35mm and 16mm films for demonstration in regular cinemas. Research and development work continued on various wide-gage film producing and projecting equipment.

Special lenses were developed for 70-mm production, including lenses with

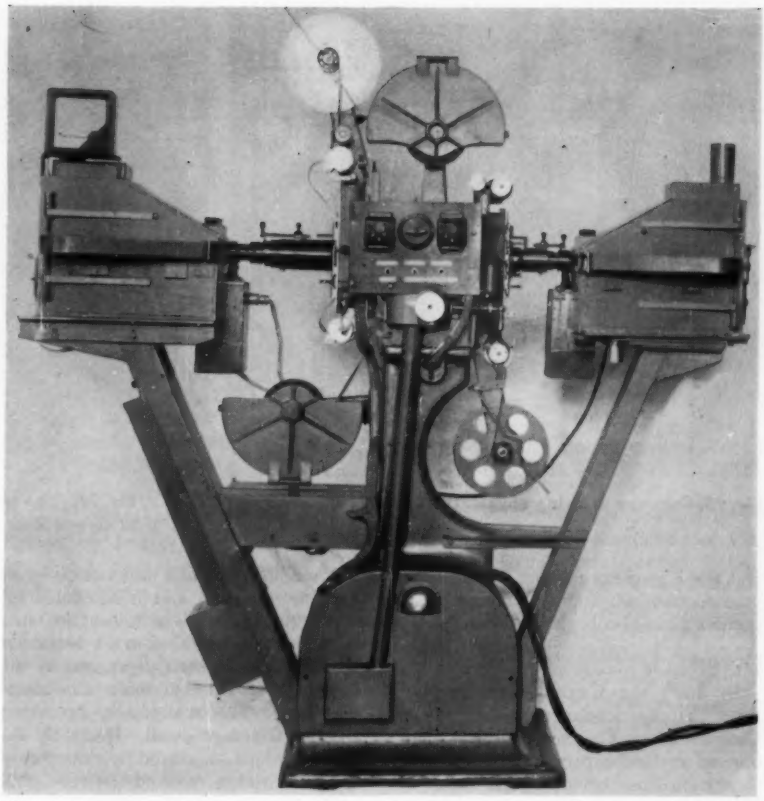

Fig. 75. Printer for 35mm release prints or dupes with anamorphic image from 70mm negative.

Fig. 76. Camera using wide film.

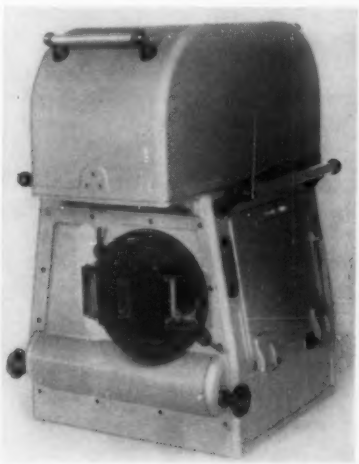

Fig. 77. Synchronous camera with a set of exchangeable lenses having a focal length from 27 to 100mm.

focal lengths of 28, 40, 56, 75, 100 and 125mm. Design work is nearly completed on wide-angle lenses of 15 and 22mm focal length free from edge distortion.[178]

A universal 70/35 motion-picture projector was designed. The luminous flux of this projector with the swung-in shutter exceeds 15,000 lm. An apparatus for printing dupes on 35mm films with standard frame size (Fig. 73); a step contact printer for mass printing of 70mm color films (Fig. 74); and an apparatus for making prints or dupes with anamorphic image on 35mm (Fig. 75) were developed. Other developments include on optical printer for work from 70mm negatives; and Cinerama prints on three separate 35mm films.

The Mosfilm Studio commenced the production of the first wide-gage color feature film tentatively entitled *The Story of the Flaming Years*. Figure 76 shows the wide-gage camera used by the Mosfilm Studio for photographing this picture.

Preparations for producing wide-gage films are under way at the Lenfilm Studio

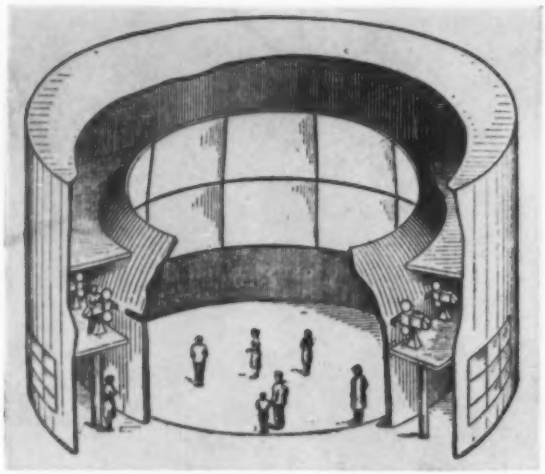

Fig. 78. Cutaway drawing of Circarama type of theater.

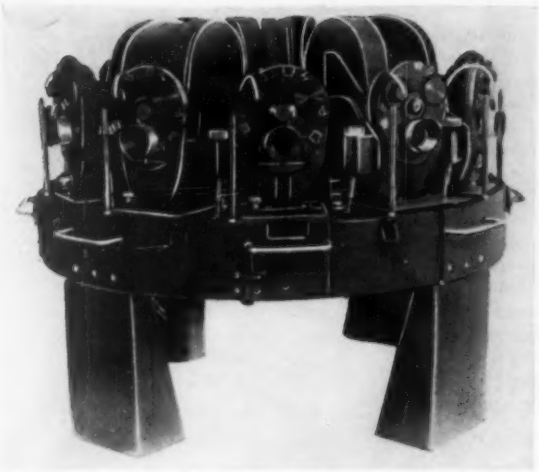

Fig. 79. The camera unit for Circular Kinopanorama consists of eleven 35mm synchronized Canvas-type cameras.

and the Kiev Feature Film Studio. The manufacture of 70mm negative and positive films also began in 1959.

Cinerama

In 1959 the Central Documentary Film Studio completed one more Cinerama film. Cinerama theaters were opened in Dnepropetrovsk, Stalino and Rostov-on-Don bringing the total of Cinerama theaters in the U.S.S.R. to six.

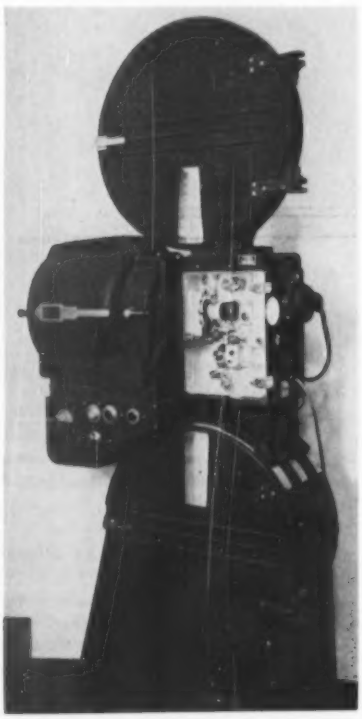

Fig. 80. Stationary 16mm shutterless projector with gas discharge xenon lamp.

A mobile Cinerama unit was designed and the first such unit is scheduled for production in 1960. The Soviet Cinerama equipment was installed in a new theater in Paris, having been purchased by the Distribution Internationale Cinematographique. This equipment, developed by the Cinematography Research Institute and manufactured by a number of Soviet factories, received a Grand Prix at the 1958 Brussels World Fair.

As an elaboration of the Soviet Cinerama system, a sync camera was designed in 1959 with a set of accessory lenses of different focal lengths ranging from 27 to 100mm. This camera (Fig. 77) has special lenses with optical attachments that change the angle between the axes according to their focal lengths.

Circarama

In July of 1959 a new Moscow theater, built for the purpose, showed *The Path of Spring*, produced by the Central Documentary Film Studio and Soyuzmultifilm Cartoon Studio using a Soviet Circarama system. In this system a film is projected onto 22 screens arranged in a circle in two tiers with 11 screens in each tier. The picture is accompanied by stereophonic sound recorded and reproduced over nine channels from a separate 35mm perforated magnetic tape. The high brightness of the screens, each of them 17 sq m in area, is obtained through the use of gas discharge xenon lamps.

The Soviet Circarama was developed by the Cinematography Research Institute while the requisite film production and projection equipment was engineered and manufactured by a number of Soviet factories. Figure 78 shows schematically a Circarama cinema and the layout of apparatus[179] in it; Figure 79 gives a general view of shooting unit consisting of 11 sync Canvas-type cameras with 120-meter magazines of 35mm film.[180] Another Circarama production by the Central Documentary Film Studio is scheduled for release in 1960.

16mm Cinematography

The U.S.S.R. has a great number of rural, club, school and mobile projection units showing 16mm color and black-and-white motion pictures. This is the reason why every picture produced is printed both on 35mm and 16mm film.

To improve the quality of sound reproduction in 16mm film units, a great amount of preparative work has been done recently for mass production of 16mm film prints with magnetic rather than optical soundtrack and for the overhaul of 16mm projectors so that they can reproduce the magnetic soundtrack.

In 1959 the manufacture of stationary 16mm shutterless projectors with gas discharge xenon lamps (Fig. 80)[181] and mobile Ukraine-4 projecting units was started. These operate from both optical and magnetic soundtracks. For this purpose they are equipped with a special magnetic head assembly and an unusual type of semiconductor amplifiers.

Magnetic tracks are applied to 16mm film prints by a suitable coating machine, capable of handling up to 3600 meters of film per hour. The track is formed on 32mm film which is then cut into 16mm film prints. Sound is recorded by the electric printing method in a special apparatus which records sound simultaneously on six film prints from a 35-mm magnetic original, while the quality of all soundtracks is automatically checked against the original by means of electronic comparators.[182]

Two new portable newsreel cameras with mirror shutters (Fig. 81), the 16SP and the 16SS, were designed[183] for 16mm applications, and TV newsreels. The 16SS camera has a low noise level and can be used for synchronous work.

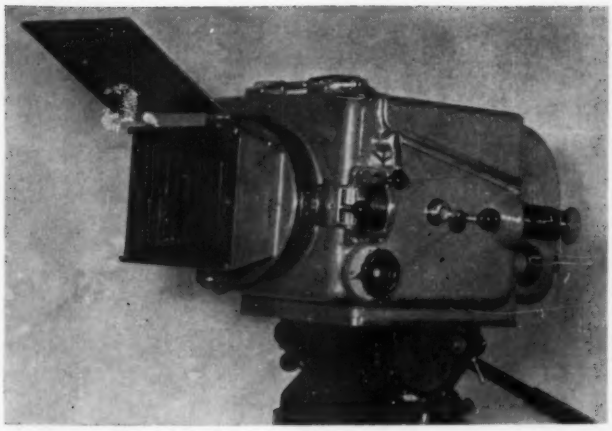

Fig. 81. 16 SS newsreel camera with mirror shutter.

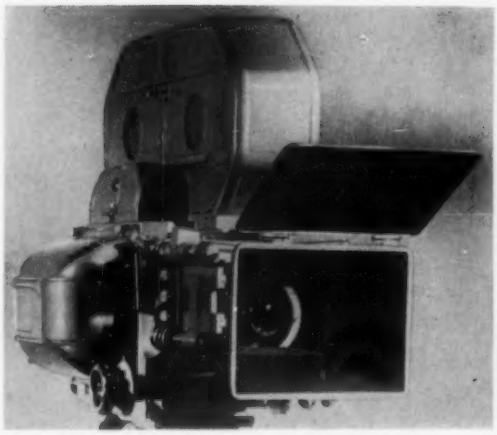

Fig. 82. Synchronous camera for feature films.

Cameras and Lenses

A new sync camera for feature film production (Fig. 82) was designed. This camera has a mirror shutter, a telephoto viewfinder and can use both standard and anamorphic lenses. Due to the low noise level, the camera permits sync close-ups to be made with short-focus lenses.

A 35mm portable camera, the Kohbac-Abtomat (Model IKCP) can be used for filming normal or wide-screen, color or black-and-white motion pictures. Designed mainly for newsreel and documentary photography, it can be held in the hand or placed on a light tripod. It has a reflecting shutter, making it possible to keep a constant view of the object being photographed. A three-lens barrel enables rapid changing of the lenses and easily detachable magazines allow quick reloading under direct light. When provided with an electric drive, the camera is started and stopped by means of a switch on the electric motor. It can also be operated with a spring drive, activated by a pushbutton (Figs. 83–86).

Other cameras announced during the year include the Rodina (KCX) 35mm camera designed for newsreel and expeditionary filming and the Moskva (KC-32) 35mm camera for synchronous filming of images and simultaneous soundtrack recording by means of a recorder on 35mm film.

A camera was also developed for animated cartoon films. The design of this camera, which uses 35mm film, embodies a number of refinements. Designated the 1-KSM (Fig. 87), this camera has automatic focusing geared to the position of the camera on the animation stand, a convenient control system and — what is most important — a mirror and a disc shutter. Supplemented by a special drive mechanism which rotates one of the shutters while the claw is motionless, these shutters allow superimposed exposures to be made on one frame. An animation stand has been developed for use with this camera.

A special camera was developed for taking pictures under water. It is easy to operate and convenient to maneuver into position while a mirror shutter and a special eyepiece make it possible for the skin-diver to frame the object and bring it into focus. The camera uses standard and anamorphic lenses.[184] The Central Documentary Film Studio color production, *At the Bottom of a Blue Bay*, was made with this camera.

In 1959, a *f*/16mm wide-angle lens[185] was developed and production of 150, 200 and 300mm focus lenses began. Thus, a whole range of Soviet-made lenses is now available for 35mm film work, including the following focal lengths: 16, 18, 22, 28, 32, 35, 40, 50, 75, 80, 100, 135, 150, 200 and 300 mm.[186] Remarkable for high definition and available in a variety of focal distances, these lenses will meet the needs of any cameraman.

A new lens with a variable focal length was developed with an aperture ratio of 1:3.8 with a focal length adjustable from 40mm to 160mm. Of small weight and good quality, it will substitute for the previous TFK-4 lens. New lenses with

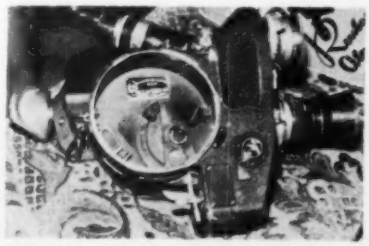

Fig. 85. Inside view of the spring motor case.

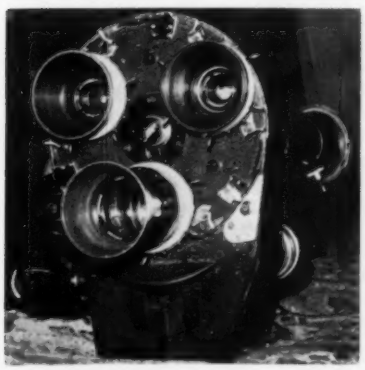

Fig. 83. Front view of Kohbac camera.

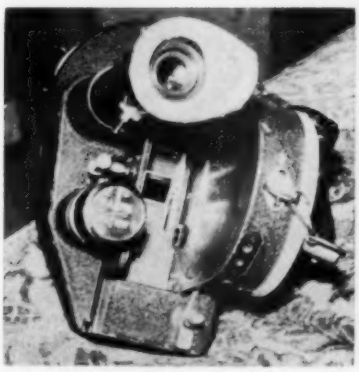

Fig. 84. Rear view of Kohbac camera.

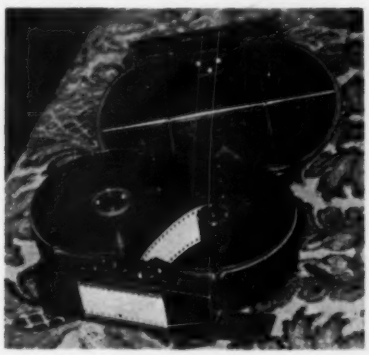

Fig. 86. Film magazine of Kohbac camera.

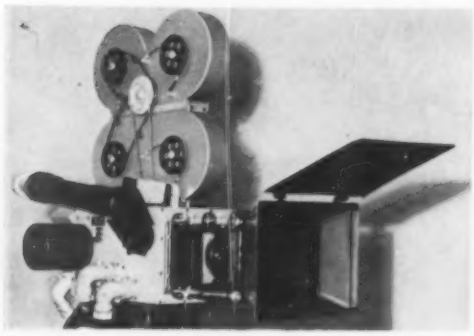

Fig. 87. 1-KSM camera for animation cartoon films.

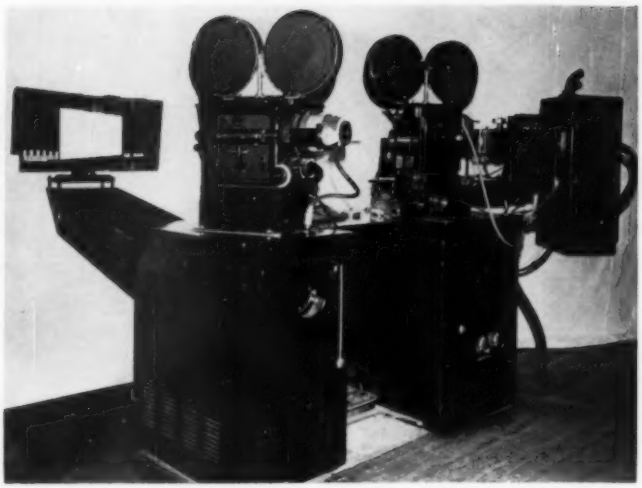

Fig. 88. Installation for optical printing of disanamorphic duplicated positives or duplicated negatives from anamorphic images.

10mm and 75mm focal lengths were designed for 16mm cameras. Further development of anamorphic 35mm systems is expected to result in improved quality and reduced dimensions.[187]

Equipment for Sound Projection

In 1959, new types of projection apparatus were developed and old ones modernized. Development work was completed on a universal projector which has a flux of 15,000 lm with the swung-in shutter. The projector is designed for use with 35mm and 70mm films. Lamphouse mirrors of a special design and the cooling system of the film path provide for the complete safety of the film. The necessary experiments were made so as to put into production a 30,000 lm projector in 1960. For small theaters in the countryside a new projector with a light flux of 3500 lm (with the swung-in shutter) was developed. It is intended to show standard and wide-screen films. The projector uses a gas discharge xenon lamp as the light source.

A new four-channel stereophonic sound reproduction system was tested. This system is of unitized construction and can be adapted to the special requirements of various theaters.

Each of the four channels can be of 25, 50, or 100 w. A completely transistorized lightweight, but robust, amplifier unit using printed circuits was devised for mobile projection installations.

Development work was continued on high-brightness screens made of new plastic materials and with high-reflectance coatings.

Trick Processes, TV Recording, Acoustics

The techniques and equipment used in the color traveling-matte method were improved last year. New light sources for infrared screens were worked out, further refinements made in the TKS-3 camera for trick process, stands for second exposures engineered, and design work started on a large infrared screen of more than 200 sq m in area.

A new static projector designated the PPU-3 was developed in 1959. It can be used for different kinds of trick photography on 35mm film.

A special machine for optical trick printing was devised. The machine[188] will mechanize many labor-consuming operations such as printing in masks, dissolves, fadings, turning frames, etc.

An optical printer was designed for printing nonanamorphic dupe positives and negatives from anamorphic negatives. The printer produces both normal and, if necessary, panoramic frames from anamorphic negatives. An important feature of the printer (Fig. 88) is that the nonanamorphic picture may be obtained without using cylindrical or prismatic optics.

In 1959, design work was practically completed on equipment for recording black-and-white motion pictures on magnetic tape. Tests of two different models of such equipment showed the high quality of video-tape recording and reproduction. A special tape of 70mm width is produced for the purpose. Figure 89 shows this equipment.

Last year wide use was made of ultrasonics hall modeling. This method makes it possible to solve intricate problems of architectural acoustics before actual design work is started on sound-recording studios, concert halls and theaters. An ultrasonics model also allows the best possible materials to be chosen so as to obtain the necessary acoustic effects in a hall. Figure 90 shows a model of Tchaikovsky Concert Hall in Moscow with improved acoustic conditions.

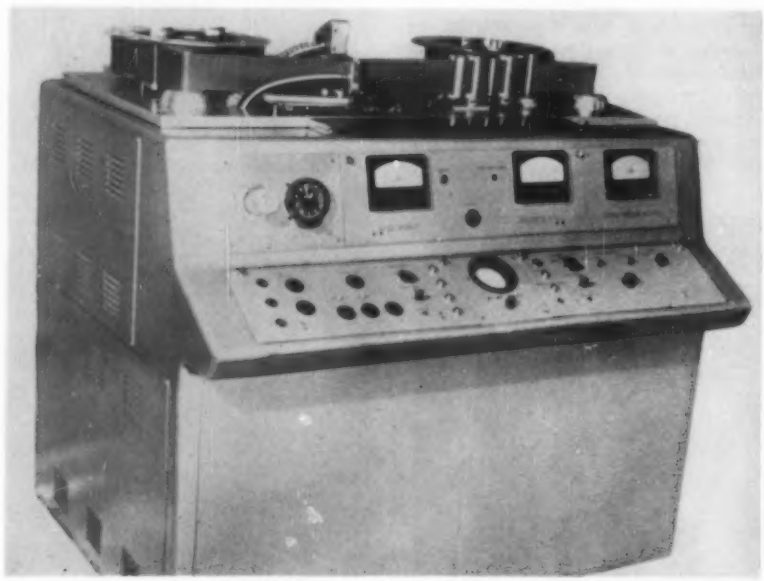

Fig. 89. Apparatus for magnetic video recording of black-and-white motion pictures.

Films

The Soviet Union turns out a wide

range of black-and-white and color films for professional and amateur use, as well as for research and applied photography.

Much money and effort is put into research and development of new film types and improvement of the existing makes.

In 1959, the new DS-3 daylight color negative film was introduced. Although its exposure index is more than ASA 100, it has increased sharpness and good color rendition.[189]

Improved color rendition and sharpness will be possible with the new DS-5 color negative film with masking components and a new color positive film with the changed sequence of emulsion layers and a black antihalo layer both produced in 1959.

Announcement of a color film with masking components for color-film duping with the aid of intermediate positives is expected in 1960.

Another addition to high-speed black-and-white negative films was the Type E. The film can be used under poor lighting conditions by day and notably with artificial light. This film has a very high integral and spectral sensitivity, and a good latitude for bringing out both high light and shadow details. Its graininess and resolution approach those of medium-speed negative films. The exposure index of this film is ASA 220, but the film may actually be exposed at ASA 350 setting.

In 1959, one more black-and-white positive film, the Type MZ-3 of extremely high sharpness was also produced. The film is free from the brown hue so characteristic of most of fine-grain films, and gives an image of crisp, black tone and wide latitude.

The Soviet Union also produces magnetic tapes for sound recording and reproduction, for various tape recorders, computers, etc. New products in this field in 1959 included a magnetic tape with high electroacoustic properties and a magnetic tape for motion-picture recording.

Television

A TV link between U.S.S.R. and Western Europe is a possibility by 1962. Coaxial cable is now being laid for the Soviet-Polish link of a proposed Socialist network that will include Hungary and East Germany. Now the Soviets say this network may tie in with the Eurovision system "if the appropriate cultural exchange agreement is reached."[190]

Intervision, a television network linking Czechoslovakia, Poland, Hungary and East Germany, has been established by the signing of an agreement between the four countries, the Czechoslovak news agency Ceteka reported on February 12, 1960. Russia, Bulgaria and Romania have announced plans to join the network. Relay operations will be carried out by a system of receivers and transmitters. The main purpose of this network linkage is reported to be exchange of programs on life in Communist countries and broadcasts of international affairs, sports and scientific events.[191]

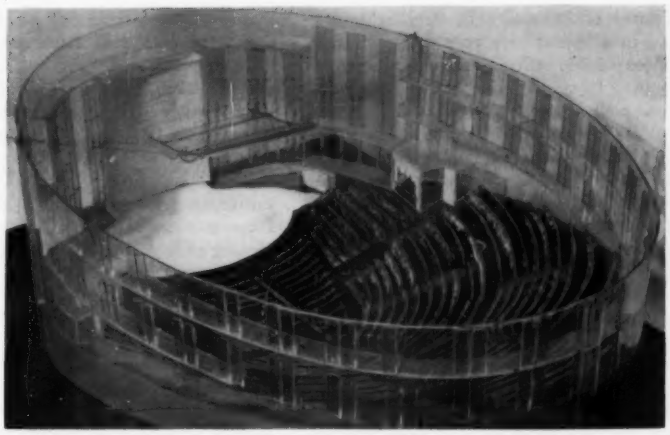

Fig. 90. A model of the Tchaikovsky Concert Hall in Moscow.

A review of Soviet equipment design was published in Electronics Information Section from the The Soviet Exposition of Science, Technology and Culture held in New York City.[192]

(See also "Moscow Impressions" by Waldemar J. Poch, p. 348 of this issue of the *Journal*.)

Venezuela

There were few changes in the motion-picture industry during 1959, so there is nothing to report from Venezuela this year.

It is expected that during the present administration a law protecting the national motion-picture industry will be issued.

International Scientific Film Association

The 13th Annual Congress of the International Scientific Film Association was held last autumn at Keble College, Oxford, England. This is an increasingly important activity and it has not previously been covered in the *Journal*. A few highlights from a detailed report prepared jointly by Reid H. Ray and Roxanne Ray (Mrs. Reid H. Ray) who attended in the capacity of observers from the United States are abstracted here.

More than 60 films were shown covering a wide range of subject matter and of widely varying quality. From an area about which the Society hears little, two films made in Czechoslovakia are described: *Motion and Time* (35mm color, 20 min) "... presented the Einstein

Fig. 91. 1959 ISFA Congress in session. The speaker (standing) is Alexandre Zgouridi, U.S.S.R., ISFA President. At his right is the interpreter, Boris Meerovitch. The interpretation (at all sessions) is in three languages. The mixing console is at the far left. Other persons at the speakers table are (second from left) Laurence Hallet, Great Britain, ISFA Chartered Secretary; Jan Jacoby, Poland, Producer; and John Maddison, MBE, Great Britain, ISFA Honorable Secretary.

Theory of Relativity in familiar terms ... in a format with very well executed photographic effects, showing persons floating in the air while riding on a railroad train. Color improved in the second reel." The second Czechoslovakian film, *On Shining Traces*, explaining basic principles of electrical discharges, was commented on as being "outstanding in photography, content, editing ... color photography (excellent) ... uses visual medium to the utmost."

Some interesting ideas were brought out during discussions on various technical subjects. A talk on film emulsions was given by Stanley Bowler who noted considerable use of Ilford Pan F film for scientific photography and commented on the advantages of 16mm reversal film over negative/positive. A French delegate, M. Lucy, stated his preference for negative/positive over reversal and said that he used a high-contrast film emulsion for microphotography. Other discussion concerned the need for quick processing of negative film.

This discussion was participated in by Mr. Ray who expressed the opinion that if closer cooperation existed between film laboratories and scientists when certain effects are desired, results would be improved. He also described certain technical problems encountered when working with the Princeton Unit on High Altitude Sun Spot Photography.

A talk by John Hadland, of Great Britain, on "Time-Lapse Studies and Survey of Time Distortion as Used in Research," included a description of an ideal camera (not now available) that could be used for all photographic time distortion—either stop-motion or high-speed. He noted that the rotating prism camera is widely used in Great Britain for high-speed work—about 50 for military purposes and many more for industrial purposes, such as analyses of vehicular collisions and other studies.

A paper with many implications for science and techniques education was that by V. L. Zhemchuzhny, "Soviet Educational Film Courses," published in the September, 1959, issue of *Science and Film*.

During the Congress attempts were made to set up criteria for popular science films to differentiate this category from research or technical films. The basis for evaluation was decided to be purposes and attitudes rather than subject matter

Conclusion

Publication of the 1958 Progress Report brings to a close for the Chairman of the Progress Report Committee and some of the members five interesting years during which new trends have become evident and a number of significant changes of emphasis have taken place. Compilation of the yearly Progress Report has not been an easy task, and the Committee is to be congratulated as a whole for its fine teamwork and, collectively and individually, the record of a fine performance year after year. It may be that some of the members, now completeing a five-year appointment, will serve again, bringing the benefit of their experience to future Progress Reports.

The Chairman, on behalf of the Committee, expresses the hope that these Reports have achieved the aim of presenting each year as comprehensive a survey as possible of the relevant events of the preceding year. It is inevitable that much of interest has been missed. Regrettable omissions may be charged to human fallibility and to the absence of reports on certain developments, since the Committee, like other newsgathering groups, is largely dependent on the cooperation of its news sources. All in all, working with this Committee has been a most gratifying experience and the Chairman wishes to take this opportunity to thank each and all of the members for their splendid contributions of time and effort.

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Dubbing in Puerto Rico

By PEDRO A. SANJUÁN

Some unusual problems are involved in dubbing from English into Spanish. A technique based on the use of a specially designed attachment for the Moviola has been developed to aid in the solution of these problems and to enable fast and accurate dubbing.

THERE ARE many varieties of Spanish. But it remains a fact that Spanish is only one language. In dubbing from English into Spanish special care must be exercised to avoid the use of Spanish words having different meanings in the various Spanish-speaking countries. In the dubbing of English-language pictures by El Mundo Enterprises, the Spanish language used is not "neutral," but rather "exact and clear." It goes without saying that, after certain words with a local or ambiguous meaning have been eliminated, the Spanish language still contains a large reserve of words which have the same meaning in Havana, in San Juan, in Veracruz, in Santiago, or in Buenos Aires.

In order to understand the problems encountered by those engaged in dubbing, one should first have in mind that our technicians are concerned only with the "labial" movement of the lips and not with "dental" or "guttural" movements of mouth and throat. This is fortunate; but let us not lose sight of the fact that in English the pronunciation of the following letters requires some sort of "labial" movement: m, b, o, f, w, and sometimes r — letters which force the English-speaking actor to close or almost close his lips. It then becomes necessary to find a word in Spanish which requires a similar closing of the lips, but which does not change the meaning of the translation. This is the basic problem of dubbing. To solve it, specially developed machines together with some ingenious technical processes are used.

One of these complicated machines is an attachment to the Moviola. Several years ago this attachment, together with a system of fast dubbing, was brought to San Juan to be used by El Mundo Enterprises.

When a film is received from the United States—say, a half-hour episode of *Have Gun Will Travel*, the series which currently appears on Channel 2, Telemundo—it comes with an English dialogue. In order to turn it into *Revolver a la Orden* the film has to pass, first of all, through the "detection section" of the El Mundo dubbing department.

Jose H. Rodriguez, chief of dubbing, describes the Moviola and attachment as a very "simple" set of mechanisms. But at first sight one gets the impression of a large jumble of little wheels through which a narrow celluloid film enters, gets lost, and reappears many times. On one side of the Moviola there is a screen the size of a postcard, in which the action of the film can be seen very clearly. The dialogue is heard through a small speaker. On a strip of frosted 35mm film (white focus leader), on which the operator of the machine is able to write with a pencil, the English dialogue is recorded in perfect synchronization with the action of the movie strip (Fig. 1). At the very moment that a word is pronounced by an actor in the movie, the word is written by the operator of the machine on the frosted film underneath a small metal pointer.

Besides writing the dialogue in English, the operator makes code signs on the frosted film. These signs have the following meaning: A long vertical line represents the complete shutting of the lips; a half-length vertical line represents a partial closing of the lips; a vertical line tipped by an arrow head means that the actor in the movie has stopped speaking.

If the lips of the actor can be seen clearly on the screen, the operator writes over the dialogue "v.w.s.," which stands for "very well seen." As the actor goes away from the camera, or twists his face away, the following initials are used to describe the clearness with which his lips can be seen: "w.s." for "well seen," "s" for "seen," "s.s." for "scarcely seen" — until the actor's mouth can no longer be seen, and the operator writes "n.s." for "not seen." When an actor begins to speak before he is seen on the screen, a line is made with an "x" at the end to indicate the exact moment the actor appears on the screen. An "x" followed by a line shows that the actor's lips disappeared from view while they were still moving.

Next, the frosted film strip (with the English dialogue and all the lines, arrows, and initials) is carefully corrected. This strip is then given to the translator together with the English script.

At home the translator begins the difficult process of translation. Not only must the dialogue be translated without loss of meaning, but Spanish words with labial or semilabial sounds must be fitted to correspond exactly with the English labial or semilabial sound emitted by the actor. The Spanish translation is made directly on the same frosted 35mm film on which the English dialogue has already been written. Once the translation is finished the translator brings it to the dubbing office to be verified.

During the process of verification the film is run through the Moviola, without sound, and the Spanish text written on the frosted film by the translator is checked. It must render the meaning of the English dialogue correctly and all labial sounds must correspond with the labial movements of the actors.

The *detection* stage should last no more than two days.

There are some translators who can finish the *translating* process in two days. Under no circumstances should this take more than a week.

The *verification* process should be done in one day. If the verification can be finished in half a day or less, the translator receives a bonus for his excellent translation.

A Spanish script is now written, following the dialogue on the frosted 35mm film.

The grouping of the different characters in each scene is done by scheduling the Spanish-speaking actors so that none of them will have to wait idly while others are recording a scene, which means that the recording of the scenes is not done in chronological order.

Actors who are going to dub the voices are selected in accordance with the personality of the English-speaking actors appearing on the film. This is the *casting* process.

The 35mm frosted film is placed on the Moviola machine with a superimposed strip of clear film. On the clear film a permanent copy of the Spanish dialogue is now made in India ink. The movie and the clear film with the dialogue in Spanish are divided into scenes of approximately one-minute duration. Each scene is rolled into a small loop. To this loop is added another roll of the same length of 16mm magnetic tape with perforations which correspond to the perforations on the movie film and to the ones on the clear film with the dialogue.

The movie with the action, the clear film with the permanent text in Spanish, and the magnetic tape are placed in two projectors and a tape recorder respectively. These three machines work in synchronization. The action is now projected on a normal movie screen. On another, longer screen, underneath the movie screen, the Spanish text passes in front of the Spanish-speaking actors, timed perfectly with the corresponding mouth movements.

The director is in the control room, and the Spanish-speaking actors are inside the studio, facing the two screens.

A contribution submitted on April 8, 1960, by Pedro A. Sanjuán, El Mundo Enterprises, Box 1072, San Juan, Puerto Rico.

Fig. 1. The detection process. An operator transcribes the original dialogue from the soundtrack to a band of frosted film.

Fig. 2. Dialogue recording. Artists before the microphone read their lines as they watch the picture during rehearsal before their voices are recorded for the series *How to Marry a Millionaire.*

Everything is ready for recording the Spanish track.

During the first viewing, Spanish-speaking actors quickly get the "feel" of the scene in English. The movie is then rerun without the English soundtrack, but with the Spanish text passing by on the long screen. This time the Spanish-speaking actors read the text as it passes before them (Fig. 2). This reading is not recorded. If the director likes the way the actors render the Spanish text as they read it, he proceeds to repeat the last stage, this time recording. Once the text in Spanish has been recorded, the scene is rerun with the freshly recorded Spanish dialogue. If the director thinks that the scene has been dubbed correctly, this entire process is repeated with the next scene.

In this quick and precise manner an average of 16 scenes can be dubbed in two hours. Fourteen half-hour episodes can be dubbed in one week. The process is simple, and efficient. Obviously, the technicians, directors and actors have to be very experienced and dedicated to their work. Only with such experts can one be sure of success in the use of a mechanized system of dubbing which serves not only to synchronize the voice to the action, but also to reproduce human emotions and subtleties with freshness and spontaneity.

Joining together the picture that has been broken into many short scenes is called *editing*. The magnetic tape which contains the Spanish dialogue is also joined together and, by the use of the Moviola and its attachment, the Spanish dialogue recorded on the magnetic tape is adjusted exactly to the action on the movie film. In some places the dialogue may be moved up slightly to coincide exactly with the labial movement of the English-speaking actor. Elsewhere, it may be slightly retarded. A deft technician advances the tape and the film, moves them back, takes out tape, cuts it, glues it, cuts more and then glues it again with amazing rapidity. With the motion picture from the United States comes a roll of magnetic tape which contains all the musical sounds and other sound effects. This tape is known as the M & E tape (Music and Effects). The film, the magnetic tape with the dialogue, and the M & E tape are divided into three equal sections to avoid having to re-dub the entire picture in case of a mishap.

So far we have the sound and the music on one tape, the dialogue on another tape and all action on one film. These elements are then combined in the mixing process, which consists, first of all, of transferring music, sound effects and dialogue into a single magnetic tape, so that they are synchronized with the action. These sounds are then transferred from tape to film by a photographic process (Figs. 3 and 4).

Fig. 3. Soundtrack mixing. The mixing control man controls the volume of the various soundtracks during the soundtrack mixing process, following standard procedures.

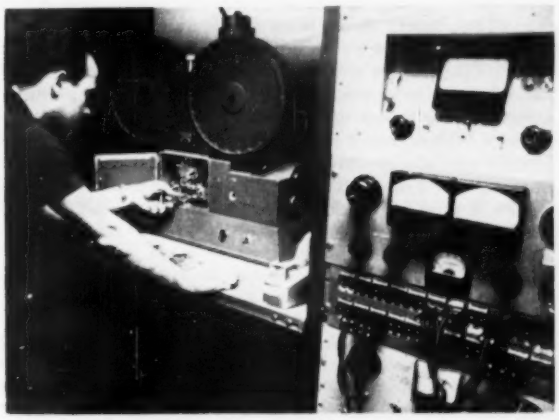

Fig. 4. Punching an identification mark on an optical recording, in preparation for re-recording of finished foreign-language track from magnetic tape to 16mm film. (Magnasync and Maurer equipment is used.)

Doing what has been described above is tricky business. Projectors are constructed so that the film, passing through the projector, goes first through the lens and later through the receiving mechanism which picks up the sound photographed on the film and turns it into audible sound. The distance from the lens to the receiver is equivalent to 26 frames; therefore, synchronization involves retarding the action by exactly 26 frames in order that the action and the sound will come out at the same time when the film is projected.

After the mixing, there is sound and action on the film, but the film is still a negative. The film is then changed to a positive, and we have the final product.

Have Gun Will Travel has become *Revolver a la Orden.*

Among the many specialists whose knowledge has contributed to the success of this operation (other than Mr. Rodriguez, mentioned earlier) are Francis Porter; Enrique Romero; Federico Buendia; Mrs. Frederick Kaufman; Milton Gaud and Pedro Enriquez.

Moscow Impressions

By WALDEMAR J. POCH

PARTICIPATION last summer in the Exhibition in Moscow sponsored by our State Department afforded an excellent opportunity for observing the current status of technical developments in the Soviet Union. An earlier visit during the latter part of 1937 and early 1938 served as a reference in judging progress during the twenty-two year interval. The purpose of this first visit was to assist in the installation and testing of the first major television broadcast station in Moscow.

The immediate impression gained from the second visit was that changes much greater than might be expected had taken place in the interval in a major advance all along the economic and scientific front. The relatively easy availability of all kinds of consumer goods in the department stores, as well as the obvious improvements in clothing, transportation, and housing, clearly indicate marked progress in the standard of living. There is still a sizeable gap that must be covered in order to achieve the standard of living we are accustomed to in the United States. However, it was apparent that a substantial portion of this gap has been closed in the last twenty-two year period.

Evaluation of the progress made in the motion-picture and television fields is the primary purpose of this article. Several visits to the Moscow Television Center and a tour through the Moscow Kinephoto Institute form the basis for this evaluation. In addition, experimental color TV equipment was seen in operation at the Permanent Exhibition of Industrial Achievements in Moscow.

The visits to the Moscow Television Center were understandably of major interest, since these brought back memories of the difficulties and successes involved in the first installation. With mixed feelings it was observed that only traces of the original equipment remain in service. The somewhat modernistic front panel assembly of the old transmitter is still in place with completely new equipment behind it, a camera pedestal still seems to be functioning properly, and the transmitting antenna tower which was old in 1937 now supports a new antenna. Transmission standards are based on the 625-line 50-field system in use throughout Europe with the exception of England and France. The original system installed in 1937 employed only 343 lines. A brief description of the facilities that are in service today follows.

Monochrome Facilities at Moscow Television Center

The original building constructed in 1937 to house two studios, one film and one live, has been expanded several times since then, and now accommodates four large studios, a new film studio, master control, kinescope recording, and numerous associated facilities.

A contribution received on April 25, 1960, from Waldemar J. Poch, Radio Corp. of America, Princeton, N. J.

Image iconoscope cameras are used in all the live studios with a standardized arrangement of the control consoles. Normal video and audio control functions are located on a single "in line" sectional console with the director's position near the center, with video control and switching on one side, audio on the other. Control monitors are arranged at strategic positions immediately to the rear and slightly above the operating control panels on the console. Since each console section is approximately 19 in. wide, the result is a rather long console with a correspondingly long control room window located at the second floor level at one end of the studio. Auxiliary equipment such as power supplies, sync generators, line amplifiers and switching relays are located in racks in a separate room adjacent to the studio control room. All this equipment gave the impression of being well designed and constructed, but already somewhat out-of-date.

The film equipment is based on the use of vidicon cameras in an elaborate optical multiplexing arrangement that permits use of several projectors, as well as slide and opaque pickup devices. The projectors are standard 35mm theater-type machines modified slightly for television use. This involves running synchronously at a rate corresponding to 25 pictures per second, a common practice in countries having a 50-cycle power system. 16mm projectors are apparently not used for TV to any great extent and were not seen in service.

A separate room houses two complete sets of kinescope recording apparatus made to accommodate 35mm film. Special ten-inch tubes are operated at 27 kv. Apparently, the system used is capable of recording full frames by means of special electronic compensating circuits.

It was stated that five mobile units are completely equipped for outdoor broadcasts. At the time of the visit to the studios, only one of these was available for inspection under nonoperating conditions. The cameras used for this purpose are similar to American cameras employing the standard three-inch image orthicon. It was observed at a later date that image-orthicon equipment supplied by Pye Limited, in England, was used for remote pickup of sporting events. Microwave relay equipment operating at 2500 mc is frequently used as a link to the transmitter location. The transmitter building also dating from 1937 is located approximately 100 yards from the studio building. Three transmitters are located here—two of these in regular service on the two program channels, the third presumably is used as a spare.

Color Studio at Moscow Television Center

The color television studio and the control room are located in a separate building recently remodeled for this purpose, after having previously been used as a receiver laboratory. The studio is approximately 30 by 40 ft in size, and is equipped with three live cameras. There is also a film studio with two sets of flying-spot scanners and associated color slide equipment.

All the camera control and auxiliary equipment, including power supplies and sync generators are located in one large room. The five camera control positions are in line but separated from each other by an open space of about five feet, so that each control position in service requires a separate operator. Each camera control is composed of four separate suitcase-type units mounted one above the other in a rack-type structure. The bottom two units contain power supplies, the top unit contains signal processing circuits, the unit below contains the principal control circuits as well as a monitor and an oscilloscope. A control panel projects from this unit near its base where the usual operating controls are located for adjusting camera voltages, deflection, centering, and so on. A monitor using a tricolor tube is located a few feet to the rear of each camera control position and receives RGB signals directly from it.

RGB signals from each camera control are also sent to the camera switching position which is in a separate room overlooking the studio through a control room window at the second floor level. Preview, output, and several auxiliary monitors are located in a row in front of two rows of console sections, one for technical and the other for program personnel. Video-switching and audio-control equipment is located in this area.

The output from the switching system is fed to a color encoder that converts the RGB signals from any of the camera controls to a single composite signal. This signal is similar to that used in the United States, but differs in several important respects. Instead of using I and Q signals with different bandwidths, a decision has apparently been made to use R-Y and G-Y signals having equal bandwidths and a 90° phase angle relationship. Since the r-f channel width in the Soviet Union is 8 mc, double sideband operation of both chromaticity channels is feasible with a subcarrier frequency of approximately 4.43 mc. The color burst signal is in phase opposition to the G-Y signal. Only one encoder is required for normal operation, but a spare unit with an associated sync generator is available on a pushbutton switch-over basis. These units are in the same room with the camera controls and are located immediately adjacent to a set of measuring equipment including an instrument similar to a vectorscope.

The cameras are approximately the same size as the RCA cameras, but use a somewhat different optical system. Apparently, three separate relay lenses are used together with associated dichroic mirrors and trimming filters. The iris opening of any of the objective lenses in the turret can be adjusted from the camera control position. Both the viewfinder and the deflection system seem considerably more compact than the equivalent units in American cameras.

The 35mm continuous projectors used in conjunction with the flying-spot scanner film system are of massive construction and give the impression of careful design and workmanship. It is understood that the principle used in these machines is similar to that employed in a Swiss design demonstrated several years ago. This is based on a split lens arrangement whereby each half of the lens is given an appropriate motion in the vertical direction by means of suitable cams to compensate for motion of the film. While some of the equipment was seen in operation, a correct evaluation of performance can only be estimated, since it was obvious that important work still remained to be done. A few comments with respect to performance may be of interest.

(1) The superimposed RGB picture seen on the black-and-white monitor at one of the camera control positions was of excellent quality. Signal noise, gray scale, resolution and registration appeared to be completely acceptable. The impression was gained that registration was substantially superior to that obtainable from current models of American cameras. However, none of the color pictures seen on any of the monitors was of acceptable quality. The major cause of this difficulty appeared to be traceable to the tricolor tubes used in these monitors. These have been manufactured on a very limited basis to date and apparently have many shortcomings.

(2) The switching system involving the simultaneous transfer of the RGB signals is relatively complex and also makes the monitoring problem more difficult. Some misgivings with respect to this arrangement were noted, and it is not unlikely that the system will be converted to the arrangement generally in use in this country where one color encoder is incorporated in each camera chain.

(3) Proper adjustment of a camera control is handicapped by rather limited monitoring facilities. On the oscilloscope it is only possible to observe each of the three colors sequentially by means of pushbutton controls, rather than simultaneously as is possible with RCA equipment.

(4) Individual controls for blanking level are available for each color channel, but a need is felt for a single overall pedestal control such as that generally found in U.S.A. equipment.

(5) The 35mm continuous film projectors and associated flying-spot scanners were in operation, but still in the early stages of overall testing. A picture originating from a 35mm color slide was not impressive, particularly since the gamma correction circuits were not yet functioning.

Color TV Demonstration at the Permanent Exhibition of Industrial Achievements

Experimental models of several types of color TV pickup and reproducing equipment had been installed in a rather large building devoted exclusively to radio and television exhibits. Besides the color equipment, a variety of monochrome equipment was on display in operational arrangements. Included were standard image-orthicon cameras; industrial TV systems using vidicons; monochrome and color receivers; and the like. Other electronic equipment on display in this building included electronic navigation aids, microwave equipment, facsimile apparatus, communication systems, AM radio sets, phonographs and audio magnetic tape devices.

A small demonstration studio equipped with an impressive amount of lighting equipment was used as a source of live program material. A single three-image orthicon camera resembling American cameras in general appearance was located in this studio. 35mm color film was televised by means of a continuous projector flying-spot scanner combination of totally different design from the one seen in the Moscow Television Center. The resulting pictures could be observed in a special demonstration room where three types of viewing devices were available. One type closely resembled a standard American tricolor receiver, the second was a projection-type unit displaying a picture of approximately the same size as that on the tricolor tube. The third was a front-projection system displaying a picture about 5 by 7 ft in size having a maximum luminance of the order of 5 to 10 ft-L. The quality of the pictures on the projection units seemed to be somewhat superior to those seen on the tricolor units. The pictures from the 35mm film machine made a better impression than the pictures from the demonstration studio from the standpoint of color fidelity, signal-to-noise ratio and resolution. The film pictures were considered acceptable, while the live pictures were close to being marginal.

Interest in these color demonstrations was impressively high, with hundreds of people waiting in line and subsequently being jammed into the demonstration room at ten-minute intervals throughout the day.

An interesting display seen in the lobby of this building was a scale model of the new antenna tower scheduled for construction in the outskirts of Moscow during the next five-year period. It is to be self-supporting, with a height in excess of 1600 ft and arranged so that the transmitter will be at an upper level

of the tower relatively close to the antenna. Elevators and restaurants at various other levels are also included in the plan.

One other item of interest in the same general area, but in another building, was the Russian version of the "Circarama," also put into service during the early part of 1959. Like its American counterpart, it also uses eleven separate screens for the 360° display. However, it has two sets of these screens, one above the other, and therefore requires 22 synchronized projectors. 35mm machines are used so that resolution and brightness appeared to be somewhat better in the Russian display. However, the quality of the color film is noticeably inferior and most of the demonstration was restricted to the lower set of the eleven projection screens.

Moscow Kinephoto Institute

This Institute is devoted entirely to research and development on motion-picture equipment for theater applications. Results of the work done here are then made available to other organizations, principally those responsible for production. It was emphasized several times during the visit that a closer relationship with similar organizations in the United States, such as the SMPTE, is considered extremely desirable.

The developments that were demonstrated showed a high level of technical competence, but substantial progress beyond the state of the art reached in other countries was not evident.

Among the demonstrations observed were the following:

1. Wide-Screen Film Projection. A moderate-sized auditorium had been equipped with a curved screen about fifty feet wide and twenty feet high. A short reel of 70mm color film with four sound channels was demonstrated. The quality of sound was excellent, and the picture quality was acceptable, although somewhat low in "chroma" by American standards.

2. Multichannel Sound. A nine-channel magnetic sound system was demonstrated without accompanying motion pictures. 35mm magnetic tape is used for this purpose. Loudspeakers associated with this system were located at the sides and the rear of the auditorium, in addition to the usual speakers in front. The results were quite impressive, as may be expected.

3. Mixing Equipment. Extensive facilities were shown for deriving one or more sound channels from multiple sources. It is understood that approximately ninety incoming channels could be accommodated. In most of this equipment, rectilinear control of mixers seems to be preferred over the normal rotational types used in this country.

4. Acoustic Laboratory. Apparently, models are used extensively as an aid in studying the acoustic properties of proposed auditoriums. This is done by using ultrasonic techniques based on placing a 20-kc transducer at the sound origination point and measuring the response at various locations with a miniature microphone.

5. Tape Laboratory. Development work is being carried on in connection with recording and reproducing sound on quarter-inch magnetic tape. Results of this work that were demonstrated showed adequate, but not unusual, performance characteristics.

Color Television Studio at the American Exhibit

A word or two about the equipment used to demonstrate American color TV in Moscow last summer might not be out of place. The basic items involved were two RCA live pickup color cameras, a 16mm film projector with its associated three-vidicon color film camera, and an Ampex Color Videotape Recorder. The studio, about 30 by 50 ft in area and raised several feet above the first floor level, was equipped with large glass panels along the long sides to permit easy observation of studio activities. An enclosed control room with the usual control console and observation window arrangement was located at one end of the studio. Approximately sixty kilowatts of lighting fixtures were suspended from a grid slightly above the second floor level. At this level, the studio was entirely open except for a protective railing so that visitors could observe action in the studio also from this vantage point. Color receivers converted for use as closed-circuit monitors were placed at strategic locations in the studio area so that observers could compare the picture on these receivers with the original in the studio.

Finding sufficient program material to keep going on a schedule of ten to twelve hours for six weeks was one of the minor problems. Other exhibitors were frequently called on for assistance, children were more than willing to help, previous programs recorded on tape were extremely useful and a large inventory of first-rate color cartoons was tremendously popular. It is not surprising that in a popularity vote, color TV took first place.

Besides the normal, constant stream of visitors, there were tours almost daily for delegations of engineers and scientists from various technical organizations. Reaction to picture quality both direct and recorded was generally quite favorable and many complimentary remarks were made.

A Commercial Cold Reflector

By H. H. SCHROEDER
and A. F. TURNER

Methods of reducing the temperature at the aperture of motion-picture projectors are discussed. The development of the cold reflector is outlined and its performance data on illumination and radiation are compared with those for the silver reflector, with and without a heat-reflecting filter. Field tests show that the cold reflector gives such desirable results as improved screen illumination; minimization of film buckle together with alleviation of out-of-focus problems; and a cooler aperture plate, an advantage in changing the aspect ratio.

FOR A NUMBER OF YEARS, especially since the introduction of wide-screen processes, a means for providing a substantial reduction in the temperature of the film strip at the aperture of motion-picture projectors has been needed. In large indoor houses and drive-in theaters, where high amperage arcs are in use, this temperature reduction would prevent much of the out-of-focus condition resulting from film buckle, as well as permanent damage to the film.

Many devices have been used[1,2,3] in the past, such as water or air cooling and heat-absorbing glasses. The requirements imposed on a system for a cooler aperture are stringent:

(1) negligible loss of screen illumination;
(2) negligible distortion of screen color;
(3) substantial reduction in total radiation;
(4) relative permanence; and
(5) simplicity of operation and maintenance.

The primary source of the heat generated at the aperture plate and in the motion-picture film is absorbed radiant energy, whether this energy lies in the visible or in the nonvisible portion of the spectrum. The metal parts of the mechanism absorb all the radiation which they do not reflect. Black-and-white prints absorb quite uniformly through the visible portion out to wavelengths near 3 μ to a degree depending on their density,[1] whereas the dyes in color film absorb in the visible portion but are relatively transparent to the infrared rays. If the radiation focused at the plane of the aperture plate could be confined to wavelengths within the visible spectrum, 0.4–0.7 μ, no unnecessary heat would be generated and considerable relief from the temperature problem would be experienced.

Multilayer Coatings in Projectors

Proceeding on this basis, it appeared that the foregoing requirements could be met by the use of multilayer optical interference coatings[4] applied by vacuum deposition methods. Optically the wavelength selective properties of these coatings may be utilized to separate the useful visual radiation of the arc from the infrared, the latter contributing substantially to the rise in temperature of the aperture plate and motion-picture film, but nothing of course to the screen illumination. Technically, furthermore, progress during the last few years in the production of commercially acceptable multilayer vacuum-deposited coatings warrants their application in motion-picture projectors despite the severe environmental conditions encountered. With these multilayer coatings two possible approaches to the problem present themselves:

(1) a heat-reflecting filter — one which transmits the visible but reflects the infrared;
(2) a heat-transmitting reflector — one which reflects the visible but transmits the infrared.

The disposition of these two types of coatings in projectors is shown schematically in Fig. 1. The top sketch shows how the heat-reflecting filter coating is conveniently applied to the draft glass and acts to reflect the infrared back into the lamphouse. Alternatively, as in the lower sketch, the conventional silvering of the glass reflector is replaced by the heat-transmitting, visible-reflecting coating. The infrared component of the radiation incident on the reflector then passes freely through it, to be dissipated at the back of the lamphouse, while the visible is reflected as usual. Both these systems have been proposed[5–11] but very few performance data under actual field conditions have appeared for either of them. Consequently some discussion of the heat-reflecting filter will also be included below.

Chronologically the heat-transmitting reflector, dubbed a "cold mirror" or "cold reflector," was known in the laboratory before the heat-reflecting filter. However, the commercial development of the cold mirror presented a great many more difficult problems from an engineering and manufacturing standpoint, and since the need for some type of heat-control device for motion-picture projection could be more quickly met with the heat-reflecting filter, this was made available first. Draft glasses, being relatively small and plano, could be coated in small vacuum chambers and in larger quantities than the 14 to 20-in. diameter elliptical reflectors in current use.

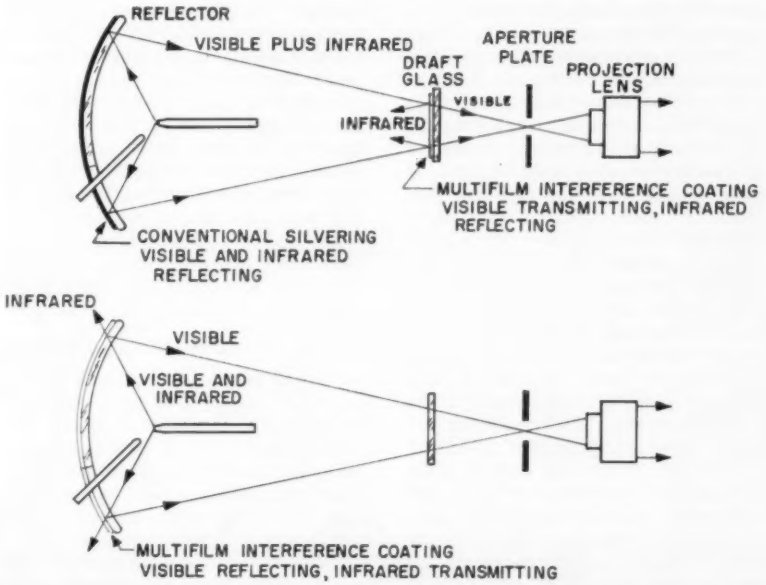

Fig. 1. Disposition of (top) heat-reflecting coatings and (bottom) heat-transmitting coatings in reflector projection systems.

Presented on May 2, 1957, at the Society's Convention in Washington, D.C., by H. H. Schroeder (who read the paper) and A. F. Turner, Bausch & Lomb Optical Co., Rochester 2, N.Y. Interim developments have been included here for publication.
(This paper was received on April 9, 1960.)

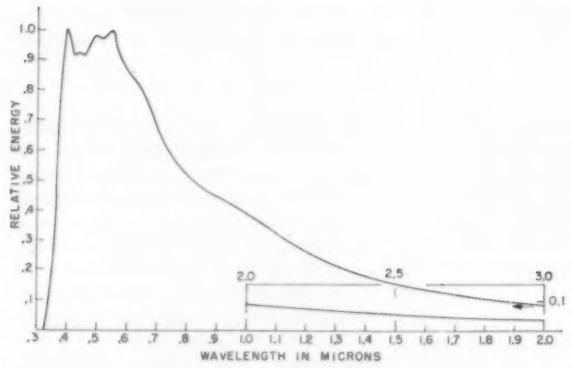

Fig. 2. Representative relative spectral energy distribution in high-intensity carbon arcs. The curve is a composite from measurements below 1 μ at the aperture of an $f/2.0$ quartz-corex condenser system using 13.6mm Super H. I. positive carbons at 170-amp, 75-v d-c and above 1 μ from measurements on the crater radiation from 16mm Super H. I. positives at 195 amp. (Data supplied by National Carbon Co.)

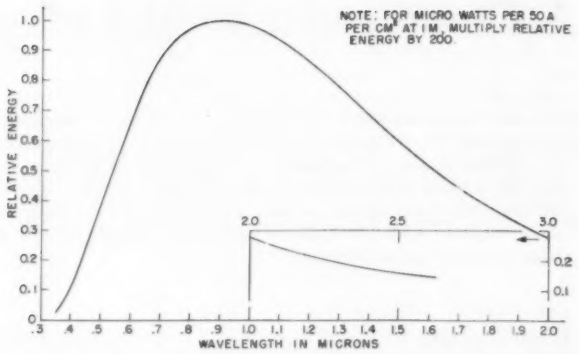

Fig. 3. Relative spectral energy distribution measured with a 500-w, 115-v tungsten projection lamp at about 3250 K.

Table I. Radiation Distribution in Carbon-Arc and Tungsten Lamp Sources From Figs. 2 and 3 as Percentages of Total Radiation.

Wavelength Range, μ	Carbon arc, %	Tungsten lamp %
<0.4	4.4	0.3
0.4–0.7	39.0	12.7
0.7–1.0	21.8	24.2
1.0–1.5	18.5	32.7
1.5–2.0	8.3	16.8
2.0–3.0	8.0	13.4

Radiation From Carbon-Arc and Tungsten Sources

Both types of coating were found effective in reducing the infrared component of the radiation at the aperture plane of high-intensity carbon-arc projectors. The spectral emission curve of such an arc is shown in Fig. 2 and by way of comparison that of a tungsten source in Fig. 3.[12] The visible spectrum spans the wavelength range from 0.4 μ in the deep blue to 0.7 μ in the deep red. Wavelengths greater than 0.7 μ lie in the infrared or heat spectrum. Table I lists the energy distribution in somewhat arbitrarily chosen spectral bands as determined from the curves with a planimeter. The substantially equal amounts of arc radiation in the two wavelength regions 0.4–0.7 μ and 0.7–1.5 μ closely match the corresponding distribution from a blackbody at 6000 K as is easily verified with a radiation slide rule.[13,14]

It is evident that a maximum reduction of 61% in radiant energy from the arc is theoretically possible without loss of illumination, since only 39% of the energy lies in the visible. Any reduction of the latter would of course be attended by a loss of light. For tungsten the maximum theoretically permissible reduction in energy without affecting light output is 87%.

The conventional back-silvered reflector, Fig. 4, returns practically all incident energy from either source out to 2.7 μ where the glass begins to absorb strongly. Figure 4 is the spectrophotometric second-surface reflectance curve of a plano glass sample with freshly deposited chemical silvering — typical, it is believed, of good commercial quality. The white-light reflectance is 93%. Much lower reflectances may be encountered. The age of the reflector is also a factor. For example, it was observed that a drop in reflectance at wavelengths below 0.6 μ occurred in a well-protected laboratory sample merely as a result of aging over a 5-year period. At 0.4 μ this decrease was 6%.

In view of the uniformly high infrared reflectance of a silvered reflector and the shape of the carbon-arc emission curve, it is evident that a heat-reflecting filter to be most effective should have its highest reflectance in the spectral region immediately adjacent to the 0.7 μ limit of the visible spectrum. Similarly, the infrared transmittance of a cold reflector should rise as rapidly as possible beyond this limit. The two types of coatings are designed with these requirements in mind. Since details of the design problem of the interference film coating lie beyond the scope of this discussion, only the final results will be presented here.

Layer Construction of Coatings

The layer construction of a heat-reflecting coating is indicated on the right in Fig. 5, and of a heat-transmitting coating on the left. The former comprises 6 alternate films of zinc sulfide and magnesium fluoride of high (2.3) and low

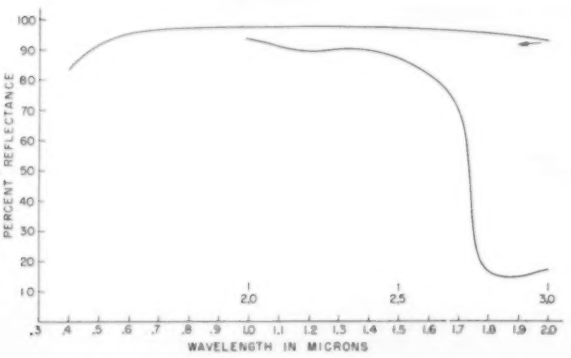

Fig. 4. Measured second-surface reflectance of chemical silvering freshly deposited on glass of 2.5-mm thickness.

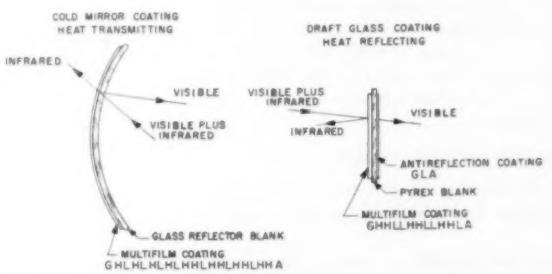

Fig. 5. Schematic construction of multiple interference film coatings for heat control in projection systems: right: a heat-reflecting coating applied to a draft glass; left: a heat-transmitting coating applied to a reflector blank.

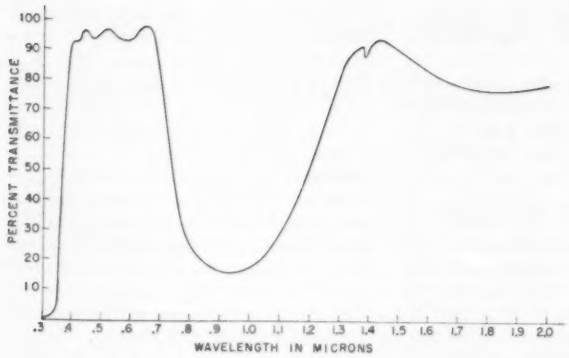

Fig. 6. Measured spectrophotometric transmittance of a representative six-layer heat-reflecting coating on Vycor, with the reverse side antireflected.

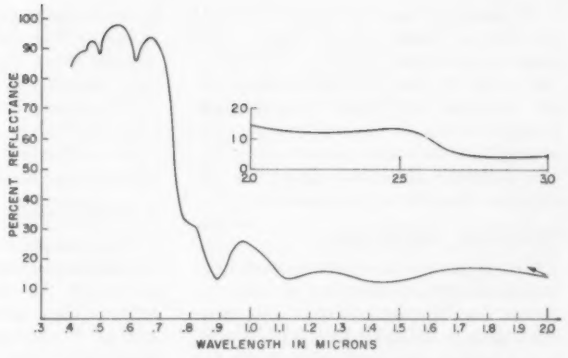

Fig. 7. Measured spectrophotometric reflectance of a representative 15-layer cold reflector coating, lacquer protected.

(1.38) refractive index, respectively. This combination of films is written GHHLLHHLLHHLA, where H stands for a film of unit quarter-wave thickness (at some specified reference wavelength) of the high-index material, L for a film of unit quarter-wave thickness of the low-index material, G for the glass or other transparent substrate and A for air. The wavelength of reference for unit film thickness lies in the green for the heat-reflecting filter. Thus at this wavelength the coating is composed of five half-wave films, alternately HH and LL, followed by a sixth, a quarter-wave low-index film L.

The heat-transmitting coating comprises 15 films in the sequence and thicknesses shown in Fig. 5, H and L again indicating films of unit quarter-wave thickness. The wavelength of reference is located in the blue-green. Because all films are nonabsorbing, the coating performance is identical whether the coating is applied to the front or the rear surface of the glass blank. Although greater manufacturing difficulties are presented in applying the coating to the rear convex surface, this procedure prevents damage by pitting from the arc. For the projectionist, rear surface coating provides a reflector which can be handled, cleaned and maintained in the same fashion as the older silvered type with which he is familiar.

The heat-reflecting filter may be antireflected to advantage, as indicated by GLA in Fig. 5, for increased transmittance in the visible. To antireflect the front concave surface of the reflector for the visible would result in a slight decrease in white-light reflectance. Some gain in infrared transmittance, too small for practical purposes, might be had with an appropriately thicker antireflection coating, one quarter-wave at, say, 1 μ.

Certain deviations from the above two coating formulations may be made in the interests of ease of manufacture. These have no significant influence on the illumination and total radiation data as presented in Table II (discussed later in the paper), for which coatings according to Fig. 5 were used.

Figure 6 is the measured spectrophotometric transmittance T of the heat-reflecting filter coating deposited on one surface of a Vycor plate, the other surface being antireflected. A glass, Pyrex or quartz plate could have been used equally well. Since the films are nonabsorbing, the reflectance R is given by $R = 1 - T$. The transmittance over the visible is higher than that of an uncoated plate. In the near infrared the transmittance drops rapidly because of a corresponding increase in reflectance. It reaches a minimum of 15% at a wavelength of 0.95 μ as determined by the choice of film thicknesses. Beyond 1.4 μ the coating loses its effectiveness in reflecting the infrared. Had the coating been composed of more films, the transmittance at 0.95 μ could have been reduced to practically zero, but at the same time the reflectance band would have become somewhat narrower. The six-film construction represents a practical compromise for motion-picture projector needs. Heat-reflecting filters result in no noticeable color distortion and are simple to install and maintain. The customary sizes range in diameter from $4\frac{1}{2}$ to $5\frac{1}{2}$ in. Because of their small size, the concentration of radiant flux on them is high, and their location near the focus makes the danger of accidentally focusing directly on them high. These factors have at times contributed to a shortened service life.

Reflectance of Cold Reflector

The measured spectrophotometric reflectance curve of the cold reflector of Fig. 5, with the addition of a protective lacquer backing, is given in Fig. 7. The average white-light reflectance compares favorably with that of a silvered reflector, i.e., it is greater than 90%. To ensure faithful color rendition, the region of high reflectance extends over the entire visible spectrum to its deep red limit at 0.7 μ. Beyond 0.8 μ the average reflectance falls to less than 15%. Out to the glass cutoff near 2.7 μ the infrared spectrum is therefore freely transmitted. Since this radiation from the arc is thereby prevented from reaching the area of the projector gate, all unnecessary heating of the motion-picture film is avoided.

Table II. Comparison of Heat-Reflecting and Heat-Transmitting Coatings in Projection Systems Relative to Chemically Deposited Silver.

	Carbon-arc source*		Tungsten source†	
	Illumination	Total radiation	Illumination	Total radiation
Silver reflector	1.00	1.00	1.00	1.00
Silver reflector with heat-reflecting filter	0.90	0.69	0.90	0.71
Cold reflector	1.07	0.59	0.94	0.30

* 9mm carbons at 90 amp.
† 6-v, 25-w auto headlight lamp.

It will be noted that the reflectance curve of the cold reflector over the visible spectrum is not smooth as for silver, but exhibits interference maxima and minima of small amplitude. The number and location of these may vary from sample to sample in consequence of manufacturing tolerances, especially in view of the complicated construction of the coating. In practice this will not introduce appreciable color distortion since the amplitudes of the undulations are kept small and their distribution regular. Although the coating remains neutral by reflection, in transmitted light these differences in the curves become apparent as differences in color shades. A cold reflector may at first sight appear "thin," an impression which is emphasized when it is judged by comparison with a silvered reflector. The latter being opaque absorbs all light which it does not reflect; the cold reflector, on the contrary, transmits this light. Since the total amount transmitted is never large, these small differences in the curves can produce distinct transmitted color differences, whereas the neutrality of the reflected light is scarcely affected.

In passing it may be mentioned that the increased color contrast reported by projectionists upon installing cold reflectors could be due in some measure to the presence of these maxima and minima, acting in reflection in a manner analogous to the color-contrast enhancing effect of the absorption bands of didymium glass filters in transmission.[15]

Illumination and Radiation

Measurements of illumination and total radiation, both relative to a silvered reflector, for the combination of a silvered reflector with a heat-reflecting filter, and for a cold reflector, are listed in Table II. Conventional motion-picture equipment was employed for the carbon-arc data, total radiation at the aperture being determined with a G.E. Radiation Meter in the Hatch arrangement[16] and illumination in the plane of the projection screen with a Weston Illuminometer having a viscor filter over the cell. The tungsten source was a 6-v, 25-w automobile headlight lamp mounted in a special test fixture, illumination and total radiation measurements being made in the second focal plane of the elliptical reflectors where the radiation was diffused with an opal glass. The reference was a freshly silvered but otherwise identical reflector. The results in Table II are averages for 10 different cold reflectors and heat-reflecting filters.

Table II shows a 10% decrease in illumination for either source upon inserting the heat-reflecting filter. At the same time, the total radiation dropped to 69% in the case of the carbon-arc source and to 71% for the tungsten source. This is a reduction in heat by about 30% in both cases. When the heat-reflecting filter was removed and the cold reflector substituted for the silvered reflector, there was a measurable gain in illumination with the arc and a small decrease with tungsten. The total radiation from the arc reaching the aperture fell to 59%, as compared to that with a silvered reflector, while for the tungsten source it dropped to 30%. This represents a heat reduction for the two sources of 41% and 70%, respectively, by the use of a cold reflector. The greater reduction when a tungsten source is employed is due, of course, to the difference in energy distribution between it and the arc, Figs. 2 and 3. The cold reflector can, therefore, be very advantageously applied in spot lamp optics[17] and other equipment utilizing tungsten lamps. In carbon-arc projectors, where there is a particularly severe heat problem, it is possible to use both the cold reflector and the heat-reflecting filter together. It has been calculated[18] from Figs. 2, 6 and 7 that the total radiation through this combination is 52% as compared to that with a silvered reflector. This is a further gain of 7% in heat reduction over the cold reflector alone.

Reflector Temperatures in Operation

The temperature conditions which motion-picture reflectors must withstand are severe. The temperature of a silvered reflector after operation of the arc for 20 min at 70 amp has been measured and found to be 560 F at the top and 510 F at the center. Similar measurements made on cold reflectors immediately after extinguishing the arc seldom show an average temperature over the surface of more than 350 F for arc operation in the range of 100–150 amp. There may be a temperature difference from top to bottom of 100–150 F, depending on the tilt of the projector. In modern projection equipment with well-designed ventilation, the maximum operating temperature of the reflector can be as much as 70 F lower, even with arc currents of 150 amp.

Despite the fact that the cold reflector coating in laboratory tests easily withstands these high temperatures, it has been found by experience that the continual temperature cycling to which a reflector coating is subjected in normal usage is evidently an important factor influencing its service life. This is particularly true at locations with high humidities, as a comparison of test data from different parts of the country reveals. Consequently, a special translucent heat-resisting lacquer was developed to seal and further protect the coating. Maximum length of service under all climatic conditions is thereby ensured.

Production and Tests of Cold Reflectors

Production of the cold reflector coatings is carried out in a 66-in. diameter vacuum chamber. This is equipped with rotating spindles upon which the glass blanks are mounted for convex side coating. The rotation assures the necessary uniformity of the film thickness. The coating durability is achieved in part by a special technique of electron bombardment[19] during film deposition. The equipment can simultaneously process four or five reflector blanks having a diameter of up to about 21 in.

Field tests over an extended period have proved the value in motion-picture projection of the performance characteristics of the cold reflectors. There is generally an impression of improved screen illumination. The projector take-up reel is noticeably cooler to the touch, and film buckle is minimized even in green or dense black-and-white prints, thereby relieving the refocusing problem. The temperature of the aperture plate is lower, an advantage in changing the aspect ratio. Conversations with many projectionists indicate that there is no objectionable rise in temperature at the rear of the lamphouse where the infrared radiation transmitted by the cold reflector is dissipated.

Acknowledgments

Acknowledgments are due our colleagues R. Kraft, J. Law, G. Smith and J. Smith for their assistance in the development of these coatings. The authors are also grateful to R. B. Dull and W. W. Lozier of the National Carbon Co., for the data for Fig. 2.

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Ballistics-Range Applications of Millimicrosecond Photography

By J. A. HULL
and G. A. THEOPHANIS

The Kerr cell electrooptical shutter has been adapted to obtain millimicrosecond, high-resolution photographs of models fired on a ballistic range. Sixteen stations employing these shutters are used to obtain aerodynamic data on nose cone models fired at velocities to 14,000 ft/sec. Energy stored in the Kerr cell pulse generator is used to generate the light pulse necessary for making the shadowgraph and schlieren exposures.

THE KERR CELL SHUTTER is one of the oldest photographic techniques in use today. As early as 1899 Kerr cells were utilized as shutters to produce short duration photographs of electrical discharge phenomena.[1] Until recently, the Kerr cell shutter was considered a laboratory device and not a piece of photographic equipment. It was necessary to maintain extremely low conductivity in the Kerr medium because of the required high d-c voltage used on the cell. The high-voltage radar pulsing techniques developed during World War II have made possible the operation of Kerr cells without a continuously applied d-c voltage. Since then, considerable work has been accomplished in developing the previously fragile laboratory cell into a unit which can be used in field operations such as exploding wire studies and explosive research facilities.

For hypervelocity ballistics range applications, the Kerr cell shutter is needed in shadowgraph and schlieren optical systems as well as in standard reflected light photographic applications. The photographic shutter must be reliable and rugged and must not require special operating techniques.

In an aero-ballistics range where projectile velocities up to 15,000 ft/sec may be obtained, it is desirable to limit the exposure time to about 50 mμsec to minimize image blur. The aerodynamic data obtained from the shadowgraph and schlieren records on these ranges include angle of attack and position of projectile with respect to a reference line, as well as the air-flow configuration around the model. Therefore, a photographic shutter must not introduce optical distortion in the resulting image and must not degrade the optical resolution. Projectiles fired at high vlocity in air at atmospheric pressure produce considerable self-luminosity. This luminosity produces unwanted exposure of the photographic film in systems employing open flash techniques. The Kerr cell is the only shutter which can meet the exposure time, optical resolution, and lack of distortion requirements for these systems.

Presented on October 9, 1959, at the Society's Convention in New York by J. A. Hull and G. A. Theophanis (who read the paper), Avco Corp., Research and Advanced Development Div., 201 Lowell St., Wilmington, Mass.
(This paper was received on October 8, 1959.)

Kerr Cell

The Kerr cell consists of a glass cell having optical windows cemented at each end with two parallel, conducting plates placed along two walls inside the cell. The cell is filled with chemically pure nitrobenzene and sealed with an expansion chamber on top. The dimensions of this expansion chamber are chosen to permit the nitrobenzene to expand and contract during normal temperature fluctuations experienced under operating conditions. This cell is placed in a plastic enclosure. Immediately adjacent to the optical windows on this enclosure are mountings for polarizing filters. The polarizer and analyzer of this unit are normally adjusted so that the plane of polarization of the polarizer is normal to the plane of polarization of the analyzer. Thus the polarized light entering the cell is transmitted by the normally isotropic Kerr medium and is absorbed by the analyzer, providing a nearly opaque shutter. When an electric potential is applied to the conducting plates of the cell, the Kerr medium causes the plane of polarization of the light to be effectively rotated so that the light arrives at the analyzer with its plane of polarization coincident with the transmission plane of the analyzer. Thus the exposure time of the shutter depends on the duration of the high-voltage driving pulse. A cell having a 2-in. optical length and a $1\frac{1}{4}$-in. aperture has been selected. The operating voltage for this cell is approximately 60 kv.

Pulse Generator

Many techniques have been developed to form a high-voltage pulse of submicrosecond duration. The Kerr cell appears to a driving generator as a capacitive load with a value of 50–100 μμf. It is desirable to charge this capacitance in a time which is short compared with the exposure time of the shutter. Thus a pulse generator having a very low driving-source impedance is required.

A transmission-line pulse generator[2] has been developed which will produce the necessary pulse amplitude, pulse duration and driving-source impedance. A schematic diagram of this pulse generator is shown in Fig. 1. The transmission line is charged to a voltage E, normally about 50,000 v, and is then discharged by means of a special high-voltage spark-gap switch when it is desired to produce a high-voltage pulse. In shadowgraph and schlieren photography, it is required that the geometry of the light source be either a small point or a line. It is possible to use the high-energy spark generated when the cable is shorted as a source so that synchronization between the light output and high-voltage pulse may be assured.

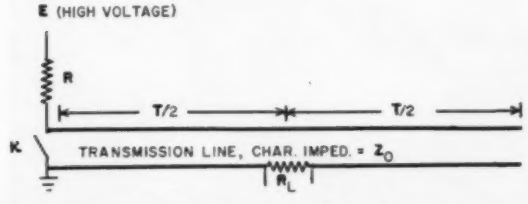

Fig. 1. Simplified diagram of transmission-line pulse generator.

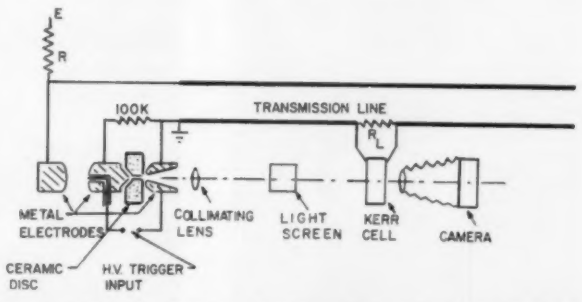

Fig. 2. Schematic diagram of pulse generator and synchronized light source as used in shadowgraph system.

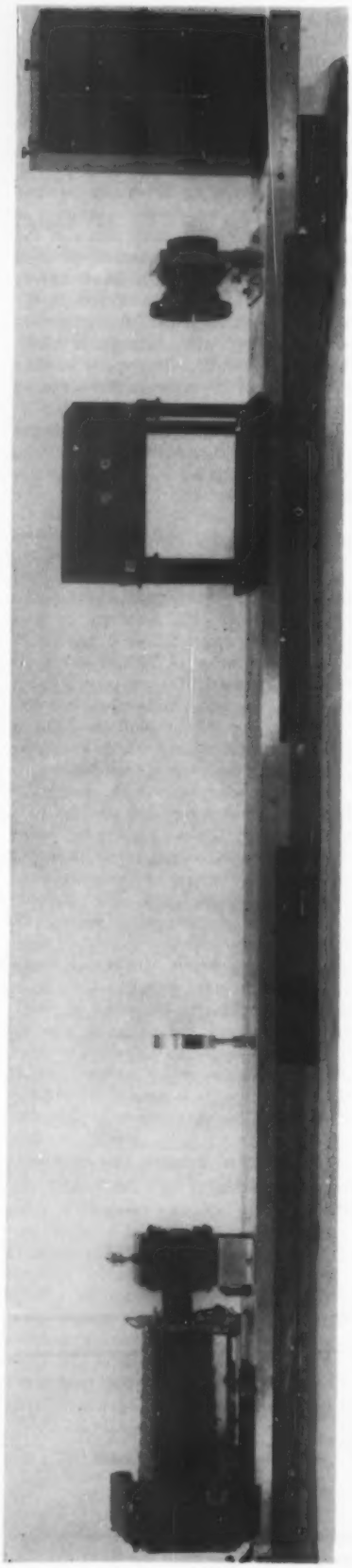

Fig. 3. Kerr cell shadowgraph station.

Shadowgraph Station

A schematic diagram of a shadowgraph system, including the above pulse generator and synchronized light source, is shown in Fig. 2. A delay of one-half the pulse duration between the initiation of the spark and the time when the shutter receives a voltage pulse permits the light produced by the arc discharge to rise to approximately peak intensity before the shutter opens. The spark-gap light source assembly consists of a double gap arrangement in which the high-voltage electrodes are contained in an atmosphere of insulating gas. The light-producing gap is a low-voltage gap which remains exposed to air. A photograph of a Kerr cell shadowgraph station which employs this synchronized point light source/pulse generator is shown in Fig. 3. An aluminum channel is used as a shield to contain the transmission-line pulse generator. This shield serves as an optical bench which supports the light source, the collimating lens, the light screen for detecting the presence of a ballistic projectile, the refocusing lens and a film plate holder. A capping shutter is used on the film plate holder to prevent ambient light from bleeding through the shutter since the crossed polarizers are not completely opaque. The open-to-closed transmission ratio of a typical shutter utilizing commercially available polarizing and analyzing filters is approximately 20,000:1. Figure 4 is an intensity vs. time waveform of the light transmitted by the Kerr cell as measured at the film plane of the shadowgraph system.

Aerodynamic Range

In order to obtain stability and drag data, 16 of these stations have been located at 5-ft intervals as indicated in Fig. 5. The even and odd stations on this aero-ballistics range are arranged perpendicular to each other as shown. Distance measurements between stations

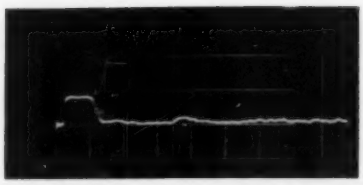

Fig. 4. Light transmission waveform of Kerr cell shadowgraph system; sweep speed 50 mμsec/division.

are made by means of calibrated Invar tapes supported by the I-beams above the stations. Plumb lines are hung from notches in the tape so that a shadow of the wire is included in the optical field at each station. A pulse is derived from the station when it fires. This pulse triggers the start or stop gate of a 10-mc chronograph. Thus the exact position of the projectile at the instant the chronograph is triggered may be determined by measuring the distance from the image of the projectile to the image of the wire. The accuracy with which these velocity measurements can be made is determined by the optical resolution of the shadowgraph station which at a 1:1 magnification is better than 20 lines/mm.

In addition to these 16 shadowgraph stations, a Kerr cell schlieren station is also used to obtain flow configuration data. A photograph of this unit is shown in Fig. 6. The exposure time of this station, as well as the shadowgraph units, is 50 mμsec. A typical schlieren photograph of a cone-shaped model is shown in Fig. 7. The velocity of this projectile was 9000 ft/sec.

This hypervelocity aerodynamic range facility has been in operation for approximately six months. It has been demonstrated that consistent high-resolution, millimicrosecond photographs can be obtained routinely in this ballistics range facility

Terminal Ballistics Range

In addition to the aerodynamic range applications of the millimicrosecond Kerr cell shutter, techniques[3] have been

Fig. 5. Light gas gun range.

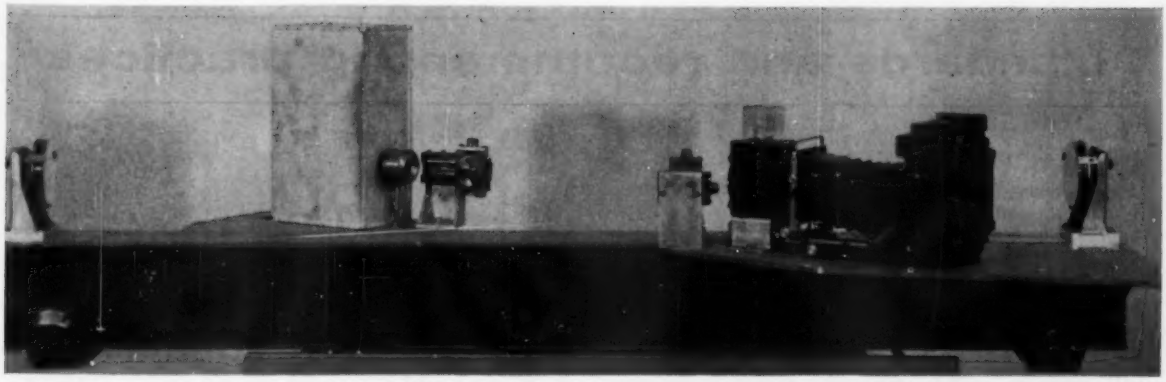

Fig. 6. Schlieren station employing Kerr cell shutter.

developed to utilize this shutter in reflected light studies of hypervelocity impact phenomena. A pulsing unit consisting of three storage capacitors and a 5C22 hydrogen thyratron is used to pulse three xenon flashtubes. This pulser also delivers a high-voltage trigger pulse to the spark-gap switch in a Kerr cell transmission-line pulse generator to synchronize the Kerr cell shutter to the light pulse with an accuracy of ± 5 mμ sec. This pulser along with a Kerr cell and relay lens system is shown in Fig. 8.

One of the problems associated with this type of photography is that of discriminating against the relatively long-duration, high-intensity flash of light which is emitted at the moment when the projectile impacts the target. This light will bleed through the crossed polarizers of a Kerr cell having the normal 20,000:1 transmission ratio. In order to discriminate against this light, it was necessary to increase the transmission ratio. This was accomplished by constructing a Kerr cell utilizing three polarizers, which is equivalent to two shutters in optical series. By using this shutter, the transmission ratio was increased to approximately 1,000,000:1. Photographs of self-luminous subjects have been made with this Kerr cell with an exposure time of 5 mμsec.

Throughout this work the films used were Eastman Royal-X Panchromatic and Polaroid Type 47. The Royal-X Panchromatic film was processed for 12 min at standard temperature in DK-50 developer. The Polaroid film was developed normally.

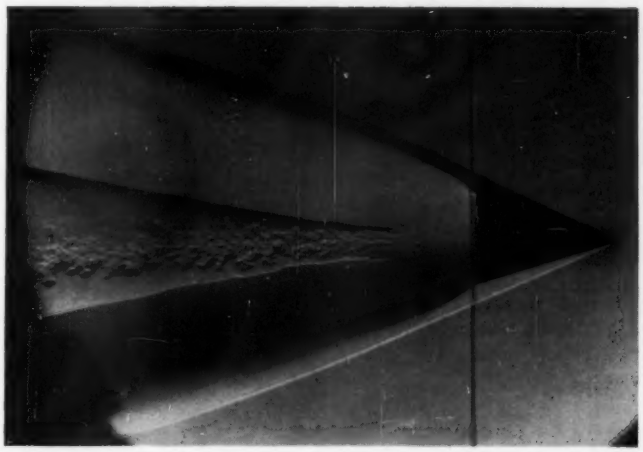

Fig. 7. Schlieren photograph of cone-shaped projectile; velocity 9000 ft/sec.

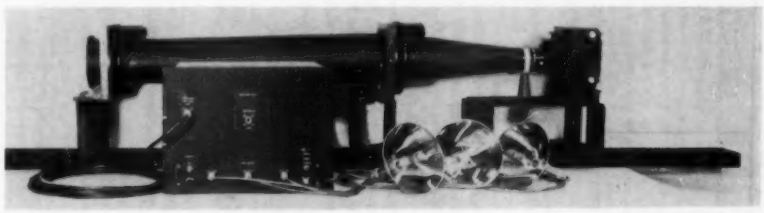

Fig. 8. Kerr cell camera and relay lens system used in terminal ballistics studies.

Summary

The development of techniques for utilizing a Kerr cell electrooptical shutter as a standard high-speed photographic tool in ballistics range applications has been demonstrated. An aerodynamic ballistics range has been instrumented with shadowgraph and schlieren stations having exposure times of 50 mμsec. A spark-gap light source and high-voltage pulse generator have been developed to provide extremely accurate synchronization between the light pulse and the Kerr cell shutter operation. The Kerr cell shutter can be synchronized with suitable light sources for reflected light photography. It can be made sufficiently opaque to operate in the presence of very strong background illuminations.

Acknowledgments

The authors would like to express their appreciation to R. N. Schweiger, S. Wolnik, H. Reese and R. Gagnon, who have contributed many ideas and considerable support in this instrumentation research program.

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Proposed American Standard

Intermodulation Tests for 16mm Variable-Density Photographic Sound Prints

PH22.51

Revision of Z22.51-1946

1. Scope

1.1 This standard specifies the technique of measuring, by the intermodulation method, the signal distortion introduced during recording, processing, printing and reproduction of 16mm variable-density sound motion-picture prints.

2. Test Method

2.1 The test track shall consist of two sections, recorded in sequence at the same lamp-current setting and printed at the same printer light step.

2.2. Section 1 shall be recorded with a combination of a low frequency, nominally 60 cps, and a high frequency, nominally 2000 cps, the complex wave having a peak amplitude of 2.0 ± 0.5 db below full modulation, in which the high-frequency level shall be 12.0 ± 1 db below that of the low frequency. In the following the low and high frequencies shall be as-

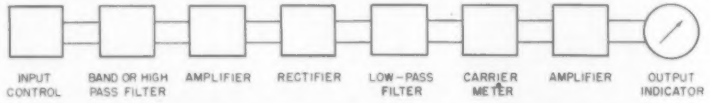

Fig. 1. Arrangement of Intermodulation Test Apparatus to Determine Distortion on Test Track

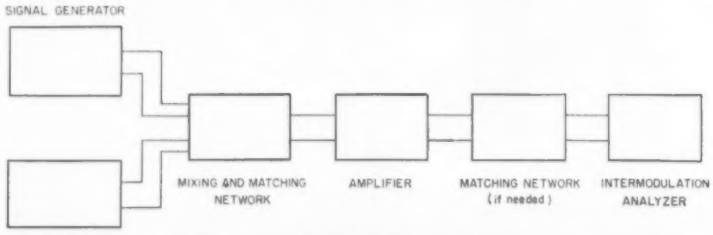

Fig. 2. Arrangement of Intermodulation Test Apparatus to Determine Distortion in Amplifier

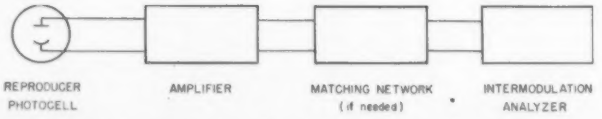

Fig. 3. Block Diagram of an Acceptable Intermodulation Analyzer

NOT APPROVED

Proposed Revision of American Standards

Published here for a three-month period of trial and criticism are four proposed revisions of American Standards: PH22.3, 35mm Photographic Sound Motion-Picture Film, Usage in Projector; PH22.43, 16mm 3000-Cycle Flutter Test Film, Photographic Type; PH22.51, Intermodulation Tests for 16mm Variable-Density Photographic Sound Prints; PH22.56, Nomenclature for Motion-Picture Film Used in Studios and Processing Laboratories.

All comments should be addressed to Society Headquarters, attention of J. Howard Schumacher, *Staff Engineer*, prior to August 15, 1960. If no adverse comments are received, the proposals will be submitted to ASA Sectional Committee PH22 for further processing as American Standards.—*J.H.S.*

Erratum

For: Proposed SMPTE Recommended Practice RP 7

Read: . . . RP 6 — Modulation Levels for Monochrome 2-Inch Video Magnetic-Tape Recording, *Jour. SMPTE, 69:* 271, Apr. 1960.

Appendix F

Volume indicators such as the Standard Volume Indicator described in American Standard Volume Measurements of Electrical Speech and Program Waves, C16.5-1954, do not indicate true peak values for complex signals such as the combination of 60 cps and 2000 cps. The peak value of the complex signal will be 2.0 db ± 0.5 db below full modulation if the low-frequency signal alone is 4.0 db below full modulation.

Appendix G

Care should be taken that the reproducer photocell and coupling circuit to the reproducer amplifier do not introduce a significant amount of intermodulation distortion. The complete reproducing system should be checked at reasonable intervals to assure acceptable test conditions.

Appendix H

The intermodulation analyzer should measure with frequency discrimination of less than ± 1 db an amplitude modulated signal for a sideband width within the frequency range of 2000 ± 400 cps. The intermodulation analyzer should have sufficient amplification to measure the high-frequency carrier at an input level of — 10 dbm, as for example, in the test described in Appendix E.

References

J. G. Frayne and R. R. Scoville, "Analysis and measurement of distortion in variable-density recording," *Jour. SMPE, 32:* 684, June 1939.

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J. Ross Macdonald, "The calibration of amplitude modulation meters with a heterodyne signal," *Proc. I.R.E., 42:* 1515–1518, Oct. 1954.

G. W. Reed and R. R. Scoville, "An improved intermodulation measuring system," *Jour. SMPE, 50:* 162, Feb. 1948.

W. J. Warren and W. R. Hewlett, "An analysis of the intermodulation method of distortion measurement," *Proc. I.R.E., 36:* 457–466, Apr. 1948.

PH22.51—NOT APPROVED

sumed to be 60 cps and 2000 cps, respectively. The test signals shall be not more than ± 3 percent from the nominal frequencies to be used. Neither frequency shall contain more than 5 percent harmonic distortion. A suitable length for this section is 6 ft, which provides about 10 sec in running time.

2.3 Section 2 shall be an unbiased, unmodulated track of sufficient length for density measurement.

2.4 The test tracks, as described in 2.2 and 2.3, shall be recorded and developed under standard conditions for the process being checked, and a series of prints of both sections 1 and 2 made at suitable printer lights to give a range of print densities above and below the expected optimum density. There shall be sufficient unspliced film ahead of the test track to permit stabilization of printer speed. The intermodulation distortion content of the recorded section of the test-track print shall then be measured using equipment as shown in Fig. 1. In making the measurements, the test-track print shall be run through the soundhead of the film-reproducing device in the proper manner according to the position of the soundtrack.

2.5 In the recording and processing of the test tracks, as the print density is purposely varied to find an optimum, all other probable variables shall be maintained at one value for a printer light series.

2.6 To determine the optimum for other variables, additional test tracks shall be made, in each of which only one variable is changed while all others are invariant. For example: The negative gamma may be changed to a new value and a new series of prints made and measured. The lowest minima for all tests, consistent with prevailing practices, represents the optima for all variables tested.

3. Test Equipment

3.1 *Amplifiers.* The recording and reproducing amplifiers shall not produce more than 2 percent intermodulation distortion when the intermodulation frequencies are introduced directly into the input, as shown in Fig. 2, at approximately the same level as that used when recording or measuring intermodulation distortion on a film.

3.2 *Intermodulation Analyzer.* A block diagram of an acceptable intermodulation analyzer is shown in Fig. 3.

APPENDIXES

(These appendixes are not a part of Proposed American Standard Intermodulation Tests for 16mm Variable-Density Photographic Sound Prints, PH22.51, but are included to facilitate its use.)

Appendix A

The intermodulation method is a means of measuring distortion which differs from the harmonic method in that the former employs a low frequency and a high frequency at one-fourth the amplitude of the low frequency, the combination being simultaneously recorded on the sound negative. Any distortion in the overall process causes a change in high-frequency amplitude in portions of the low-frequency cycle. The ratio of the average variation in amplitude of the higher frequency in the reproduced wave to its original amplitude is called the intermodulation distortion. Intermodulation distortion test results are not directly proportional to harmonic distortion measurements.

Appendix B

Through measurements of intermodulation distortion at various print densities, it is possible to choose a print density which will give sound prints having minimum intermodulation distortion and hence optimum quality for the particular method of processing employed. For good results the intermodulation distortion minima should not exceed 10 percent.

Appendix C

In most cases the prints mentioned in 2.4 will be in the density range from 0.4 to 0.7.

Appendix D

The variables mentioned in 2.5 and 2.6 include the films (both sound negative and print), recorder lamp current, negative gamma, positive gamma, spectral-energy distribution of printer light and type of printer (contact or optical). Any type of modulation in the amplitude of the higher frequency at a lower frequency rate, such as may result from variations in the degree of contact between negative and print in a contact printer, will be also measured on an intermodulation analyzer.

Appendix E

A periodical test for spurious variations is recommended, whereby a third section of test track should be recorded as described for section 1 in paragraph 2.2, except that the low-frequency signal is omitted. Intermodulation distortion measured from this recording will be other than that caused by the nonlinearity of the negative exposure-print density characteristic.

Proposed American Standard

16mm 3000-Cycle Flutter Test Film, Photographic Type

PH22.43

Revision of PH22.43-1953

1. Scope

1.1 This standard specifies a 3000-cycle sound test film for use in determining the amount of flutter in 16mm sound motion-picture projectors.

2. Test Film

2.1 *Recording.* The test film shall have either an originally recorded, direct-playback positive variable-area sound record or an originally recorded variable-density sound record developed as a toe record.* The recorded frequency shall be within ± 25 cycles of the nominal 3000-cycle frequency. The modulation of the recording shall be 80 ± 5 percent. The output level of the film shall be constant within ± 0.25 db. (This is equivalent to an amplitude tolerance of ± 0.0015 in. when recording variable-area sound records with a nominal amplitude of 0.055 in.) The recording shall be accomplished in a recorder so constructed as to keep the flutter content to the absolute minimum consistent with the state of the art. The total rms flutter content of the film shall be less than 0.07 percent upon shipment by the test manufacturer, as defined in American Standard Method of Determining Flutter Content of Sound Recorders and Reproducers, Z57.1-1954. The waveform distortion of the recording shall not exceed 5 percent.

2.2 *Film Stock.* The film stock shall be of safety type, cut and perforated in accordance with American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953.

2.3 *Standard Length of Film.* The standard length of the flutter test film shall be 380 ft.

2.4 *Leader and Trailer.* Each test film shall be furnished with a suitable leader, title and trailer.

3. Revision of American Standard Referred to in This Document

3.1 When the following American Standards referred to in this document are superseded by a revision approved by the American Standards Association, Incorporated, the revision shall apply: American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953; American Standard Method of Determining Flutter Content of Sound Recorders and Reproducers, Z57.1-1954.

Note: A test film in accordance with this standard is available from the Society of Motion Picture and Television Engineers.

*References

Donald Mackenzie, "Straight-line and toe records with the light valve," *Jour. SMPE*, 17: 172-202, Aug. 1931.

C. R. Keith and V. Pagliarulo, "Direct-positive variable density recording with the light valve," *Jour. SMPE*, 52: 690-698, June 1949.

Proposed American Standard

35mm Photographic Sound Motion-Picture Film, Usage in Projector

PH22.3

Revision of PH22.3-1954

1. Scope

1.1 This standard specifies the location of the photographic emulsion, the rate of projection and the relationship between photographic sound and picture of 35mm sound motion-picture film.

2. Position of Emulsion

2.1 Except for special processes, the emulsion shall be toward the light source in the projector as shown in the diagram.

3. Rate of Projection

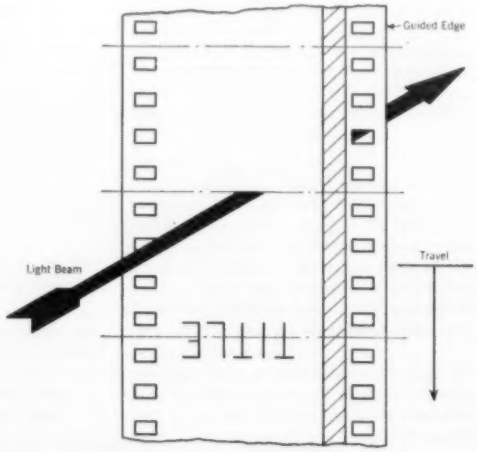
3.1 The rate of projection shall be 24 frames per second.

4. Relationship Between Photographic Sound and Picture

4.1 When the photographic sound record is reproduced, the distance from the center of the projector aperture to the photographic sound scanning point shall be adjusted to bring the picture and photographic sound into synchronism for the average observer. Usually this separation will be 20 frames, and this will provide synchronism for an observer at a distance of 50 ft from the speaker. The location and dimensions of the photographic sound record shall be as specified in American Standard Photographic Sound Record on 35mm Prints, PH22.40-1957.

5. Revision of American Standard Referred to in This Document

5.1 When the following American Standard referred to in this document is superseded by a revision approved by the American Standards Association, Incorporated, the revision shall apply: American Standard Photographic Sound Record on 35mm Prints, PH22.40-1957.



Drawing shows film as seen from the light source in the projector.

NOT APPROVED

Proposed American Standard

Nomenclature for Motion-Picture Film Used in Studios and Processing Laboratories

PH22.56

Revision of Z22.56-1947

1. General

1.1 *Motion-Picture Film.* Motion-picture film is a thin flexible ribbon of transparent plastic having perforations and bearing one or more sensitized layers capable of producing photographic images.

Note: The term "film" may be applied to unexposed film, to exposed but unprocessed film and to exposed and processed film.

1.1.1 *Raw Stock.* Raw stock is film which has not been exposed or processed.

1.1.2 *Film Base.* Film base is the plastic material upon which a photographic emulsion is coated; namely the support for the emulsion in photographic film.

Note: All film base manufactured in the United States for motion-picture use since 1952 has been safety base.

1.1.2.1 *Safety Base.* Safety base is the slow-burning film support used for motion-picture films which complies with American Standard Motion-Picture Safety Film, PH22.31-1958.

1.2 *Magnetic Film.* Magnetic film is a film base having perforations along one or both edges and bearing a ferromagnetic coating capable of accepting magnetic records.

Note: Unperforated materials usually are referred to as magnetic tape.

1.3 *Film Perforations.* Film perforations are the regularly and accurately spaced holes that are punched throughout the length of motion-picture film. These holes are engaged by the teeth of various sprockets and pins by which the film is transported and positioned as it travels through cameras, processing machines, projectors and other film-handling machinery.

1.3.1 *Perforation Pitch.* The perforation pitch is the distance from the bottom edge of one perforation to the bottom edge of the next perforation, measured along the length of the film.

Note: Perforations are being identified currently by two-letter designations such as BH (Bell & Howell), KS (Kodak Standard), DH (Dubray-Howell) or CS (CinemaScope). The numeral, such as 1866, designates the pitch in ten-thousandths of an inch. The designation 1R, 2R or 4R, used with films having 16mm perforations, refers to the number of rows of perforations across the narrow dimension of the film.

1.3.2 *35mm Perforation, BH-1866.* The 35mm negative perforation has sharp corners, curved sides, a maximum width of 0.110 in. and a height of 0.073 in. (American Standard Dimensions for 35mm Motion-Picture Short-Pitch Negative Film, PH22.93-1953).

Note: This perforation is used for negative and some special-purpose 35mm films.

1.3.3 *35mm Perforation, KS-1870.* The 35mm positive perforation is rectangular in shape, with a width of 0.110 in., a height of 0.078 in. and a fillet in each corner with a radius of 0.020 in. (American Standard Dimensions for 35mm Motion-Picture Positive Raw Stock, PH22.36-1954).

Note: This perforation is used on most positive 35mm film.

1.3.4 *35mm Perforation, DH-1870.* This perforation is rectangular in shape, with a height of 0.073 in., a width of 0.110 in. and a fillet in each corner with a radius of 0.013 in. (American Standard Dimensions for 35mm Motion-Picture Film Alternate Standards for Either Positive or Negative Raw Stock, PH22.1-1953).

Note: This perforation is used on 35mm color print film.

1.3.5 *35mm Perforation, CS-1870.* This perforation is rectangular in shape, with a height of 0.073 in., a width of 0.078 in. and a fillet in each corner with a radius of 0.013 in. (American Standard Dimensions for 35mm Motion-Picture Films, CS-1870, PH22.102-1956). The outer edge of this perforation is at a different distance from the edge of the film than the other 35mm film perforations listed above.

Note: This perforation is used mainly on color positive film.

1.3.6 *16mm Perforation.* The 16mm perforation is rectangular in shape, with a height

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of 0.050 in., a width of 0.072 in. and a fillet in each corner with a radius of 0.010 in. It is used on the following films:

1.3.6.1 *35mm Motion-Picture Film Perforated 32mm, 2R-2994.* This is a 35mm film with 16mm perforations so arranged that if 1½ mm were slit from each edge of the film and the film were slit down the middle, two 16mm films would result, each having one row of perforations. The perforation pitch (0.2994 in.) is normally used for negative film and some special-purpose films (American Standard Dimensions for 35mm Motion-Picture Film, Perforated 32mm, 2R-2994, PH22.73-1958).

1.3.6.2 *35mm Motion-Picture Film Perforated 32mm, 2R-3000.* This is a 35mm film with 16mm perforations so arranged that when 1½ mm are slit from each edge of the film and the film is slit down the middle, two 16mm films result, each with one row of perforations. The perforation pitch specified is normally used for positive film and some special-purpose films.

1.3.6.3 *32mm Motion-Picture Film, 2R-3000.* This is a film 32mm in width which when slit down the middle results in two 16mm films each having one row of perforations (American Standard Dimensions for 32mm Motion-Picture Film, 2R-3000, PH22.71-1957). This perforation pitch is used mainly on positive film.

1.3.6.4 *32mm Motion-Picture Film, 4R-3000.* This is a film 32mm in width which when slit down the middle results in two 16mm films each having two rows of perforations (American Standard Dimensions for 32mm Motion-Picture Film, 4R-3000, PH22.72-1957). This perforation pitch is normally used on positive film.

1.3.6.5 *16mm Motion-Picture Film, 1R-2994.* This film is 16mm in width, perforated along one edge only (American Standard Dimensions for 16mm Motion-Picture Film, 1R-2994, PH22.109-1958). This perforation pitch is normally used on negative film.

1.3.6.6 *16mm Motion-Picture Film, 1R-3000.* This film is 16mm in width, perforated along one edge only (American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953). This perforation pitch is normally used on positive film.

1.3.6.7 *16mm Motion-Picture Film, 2R-2994.* This film is 16mm in width, perforated along both edges (American Standard Dimensions for 16mm Motion-Picture Film, 2R-2994, PH22.110-1958). This perforation pitch is normally used on both black-and-white and color camera films.

1.3.6.8 *16mm Motion-Picture Film, 2R-3000.* This film is 16mm in width, perforated along both edges (American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953). This perforation pitch is normally used on positive film.

1.4 *Photographic Emulsions.* A photographic emulsion consists of dispersions of light-sensitive materials in a colloidal medium, usually gelatin, carried as a thin layer on film base.

Note: Photographic materials are usually designated as negative or positive types according to their light sensitivity (speed), or usage, negative emulsions, in general, being more sensitive than positive emulsions.

1.4.1 *Black-and-White Film.* Black-and-white film carries an emulsion in which brightness values of a scene after processing are reproduced only in tones of the gray scale.

1.4.2 *Color Film.* Color film carries an emulsion in which brightness values are reproduced in terms of color scales.

1.4.3 *Reversal Film.* A reversal film is one which after exposure is processed by a first development, a bleach and a redevelopment to produce a positive image. If exposure is made by printing from a negative, a negative image is produced directly.

1.5 *Image (Photographic).* An image is any photographically obtained likeness on a film emulsion.

1.5.1 *Latent Image.* A latent image is the invisible image registered on a photographic emulsion due to the reaction produced in the emulsion by exposure to radiant energy.

Note: This image becomes visible after development.

1.5.2 *Picture Image.* A picture image is a photographically obtained likeness of any object on photographic material.

1.5.3 *Sound Image.* A sound image is a photographically obtained soundtrack or sound record.

1.5.4 *Negative Image.* A negative image is a photographic image in which the brightness scale is approximately inverted with respect to the brightness scale of the original subject. In color negatives the hue scale is usually, but not necessarily, inverted with respect to the hue scale of the original subject in addition to the inversion of the brightness scale.

1.5.5 *Positive Image.* A positive image is a photographic replica in which the tones of the gray scale or color values of the originally photographed subject are represented in their natural order.

1.5.6 *Black-and-White Image.* A black-and-white image is an image produced on a black-and-white film.

1.5.7 *Color Image.* A color image is an image produced on a color film.

1.5.8 *Anamorphic Image.* An anamorphic image is an image which has been produced by an optical system having different horizontal and vertical magnifications.

Note: Equal horizontal and vertical magnification is assumed unless the term anamorphic is applied specifically.

1.6 *Aspect Ratio.* Aspect ratio is the ratio of width to height of a projected picture image.

Note: This is the more common usage, although the term is also applied to photographic images and to camera, printer and projector apertures.

1.7 *Synchronism.* Synchronism is the relation between the picture and sound with respect either to the physical location on the film or films or to the time at which corresponding picture and sound are seen and heard.

1.7.1 *Projection Synchronism.* Projection synchronism is the time relation between picture and corresponding sound in a projection print.

Note: The sound record on a projection print is, in most cases, in advance of the corresponding picture. The displacement is specified in picture frames in the following American Standards:

	Soundtrack	Standard
A	35mm Photographic	PH22.40-1957
B	16mm Photographic	PH22.41-1957
C	35mm Magnetic*	PH22.103-1957
D	16mm Magnetic	PH22.112-1958
E	8mm Magnetic	†

*In this case, the sound is behind the corresponding picture.

†A standard is now under consideration by the SMPTE Sound Engineering Committee.

1.7.2 *Editorial Synchronism.* Editorial synchronism is the relationship between the picture and sound film during the editorial process.

Note: During the editorial process, the soundtrack and corresponding picture, whether on the same or separate films, are kept in alignment and not offset as for projection. Many composite release negatives are supplied in editorial synchronism.

1.7.3 *Camera Synchronism.* Camera synchronism is the relation between picture and soundtrack in a composite camera original.

Note: Camera synchronism is generally not the same as editorial synchronism. In 16mm single systems the two are normally in projection synchronism but this is not the case for most 35mm single systems (i.e., where picture and sound are recorded on the same film).

1.8 *Exposure.* Exposure is the process of subjecting a photographic film to suitable intensity of radiant energy for a given time in such manner that it may produce a latent image on an emulsion.

Note: Exposure = intensity × time.

1.9 *Processing.* Processing is the generic term applied to the total operation necessary to produce a permanent visible image on exposed film.

1.9.1 *Development.* Development is that part of processing which makes visible the latent image of an exposed photographic emulsion.

1.9.2 *Fixing (Fixation).* Fixing (fixation) is that part of processing which removes the residual sensitive silver halides from a developed film to render the developed image permanent.

Note: During the process of fixation, films are customarily treated to preserve and harden the developed image.

1.9.3 *Bleaching.* Bleaching is that part of processing which converts a developed silver image into a silver salt.

1.10 *Printing.* Printing is the operation of exposing raw stock by using the processed image of another film as the light modulator.

1.10.1 *Contact Printing.* Contact printing is that method of printing in which the raw stock is held in intimate contact with the film bearing the image to be copied.

1.10.1.1 *Step Contact Printing.* Step contact printing is that method of contact printing in which the film being copied and the raw stock are advanced intermittently frame-by-

frame, being exposed to the printer light only when stationary.

1.10.1.2 *Continuous Contact Printing.* Continuous contact printing is that method of contact printing by which the light modulating film and the raw stock move at the same constant speed past the printing aperture.

1.10.2 *Projection Printing (Optical Printing).* Projection printing (optical printing) is printing by projecting the image to be copied through an optical system onto the raw stock.

Note: The printed image with respect to the projected image may be identical, an enlargement or a reduction or anamorphic image; or additional anamorphosis may be added or removed.

1.10.3 *A and B Printing.* A and B printing is a method of making composite images, such as fades, dissolves or effects in a release printer without requiring a duplicating process.

Note: The name comes from the fact that the films are edited into two separate rolls called A and B rolls. The sequences of pictures originally in one roll are in synchronization with opaque leader in the other roll. When these two are printed in a separate operation onto a single roll or raw stock, an opportunity is afforded for the introduction of effects.

1.11 *Projection.* Projection is the presentation of an enlarged image of the film on a screen for visual review. In addition the sound may be reproduced for aural review.

1.12 *Production.* Production is the general term used to describe the processes involved in making all the original material that is the basis for the finished motion picture.

1.13 *Editorial Process.* Editorial process is the term used to describe the combining, cutting, editing and other preparation of material obtained from the original material to make the finished motion picture.

1.14 *Re-recording.* Re-recording is the electrical process of transferring sound records from one or more films, magnetic tapes or discs to other film, tapes or discs.

Note: Re-recording may be used to combine different sound records into a single record to adjust the frequency-response characteristic or to adjust the relative levels between different scenes and sequences.

1.15 *Release.* Release is a generic term used to designate films used or intended for general distribution and exhibition.

1.15.1 *Release Negative.* A release negative is a complete negative prepared specifically for printing release prints.

Note: A release negative may consist of separate picture and sound negatives and may be in either projection or editorial synchronism, depending upon the film-processing technique to be employed in making release prints.

1.15.2 *Release Print.* A release print is a print made from the release negative.

2. Picture Negative Film Black-and-White and Color

2.1 *Picture Negative.* A picture negative is any processed film that possesses a negative picture image of the subject or film image to which it was exposed. This term is sometimes erroneously used to refer to the raw film before processing, either with or without exposure.

2.1.1 *Original Picture Negative.* The original picture negative is the negative film that is exposed in a camera and processed to produce a negative image of the original subject.

2.1.2 *Background Plate Negative.* A background plate negative is a picture negative which is used for printing background plates.

2.1.3 *Picture Library Negative.* A picture library negative is a picture negative that is usually held in a film library for use in reproducing scenes which would otherwise have to be made as original material for each production.

2.1.4 *Title Negative.* A title negative is a negative that is exposed to a title card or to both a title card and background.

2.1.5 *Picture Duplicate Negative.* A picture duplicate ("dupe") negative is a picture negative made from black-and-white, color or separation master positive films.

Note: It may be used for making additional prints or it may be cut and edited to form a part of the picture release negative.

2.1.5.1 *Internegative.* An internegative film is a negative derived directly from a color reversal original film.

Note: All other color duplicating negatives derived from other than reversal film will be known as color duplicate negatives regardless of the generation.

2.1.6 *Picture Release Negative.* A picture release negative is a cut and edited picture negative used for printing the picture portion of release prints.

Note: It may consist of intercut original picture negatives, picture dupe negatives, etc., depending upon the number of scenes and the number of prints required.

negatives which would be used for printing release prints.

Note: It is usually made on duplicating positive film and may be in either editorial or projection synchronism.

3.2.6 *Foreign-Version Release Prints.* Foreign-version release prints are composite prints in projection synchronism and are made specifically for the particular language version involved.

3.2.7 *Foreign-Version Trial Composite Prints.* Foreign-version trial composite prints are similar to trial composite prints made during release except that they are made for checking the release of the particular language version involved.

4. Reversal Film Black-and-White and Color

4.1 *Reversal Original.* A reversal original is the film that is originally exposed in a camera or recorder and is processed by reversal to produce a positive image.

Note: This positive image obtained by the reversal process is not the same as a print from a negative inasmuch as right and left are transposed; when viewed by projection on an opaque screen, the emulsion side of the print from a negative must face the light source and the emulsion side of a reversal original must face the lens in order for the screen image to have the same lateral orientation as the original scene.

4.1.1 *Composite Reversal Original.* A composite reversal original is a reversal original which has both picture and corresponding sound on the same film.

4.2 *Reversal Print.* A reversal print is a reversal-type film that has been exposed to a positive film image, usually a reversal original film, and processed by the reversal process.

4.2.1 *Reversal Master Print, 16mm.* A reversal master print is a 16mm reversal print made specifically for use in producing other prints.

Note: It is sometimes referred to as a first generation duplicate, prints from it then being referred to as second generation duplicates.

4.2.2 *Reduction Reversal Print, 16mm.* A reduction reversal print is a reversal print made on 16mm reversal film from a 35mm positive by reduction printing and development by the reversal process.

Revision of American Standards Referred to in This Document

When the following American Standards referred to in this document are superseded by a revision approved by the American Standards Association, Incorporated, the revision shall apply:

PH22.1-1953, Dimensions for 35mm Motion-Picture Film Alternate Standards for Either Positive or Negative Raw Stock.
PH22.5-1953, Dimensions for 16mm Film, Perforated Two Edges.
PH22.12-1953, Dimensions for 16mm Film, Perforated One Edge.
PH22.31-1958, Motion-Picture Safety Film.
PH22.36-1954, Dimensions for 35mm Motion-Picture Positive Raw Stock.
PH22.40-1957, Photographic Sound Record on 35mm Prints.
PH22.41-1957, Photographic Sound Record on 16mm Prints.
PH22.71-1957, Dimensions for 32mm Motion-Picture Film, 2R-3000.
PH22.72-1957, Dimensions for 32mm Motion-Picture Film, 4R-3000.
PH22.73-1958, Dimensions for 35mm Motion-Picture Film, Perforated 32mm, 2R-2994.
PH22.93-1953, Dimensions for 35mm Motion-Picture Short-Pitch Negative Film.
PH22.102-1956, Dimensions for 35mm Motion-Picture Film, CS-1870.
PH22.103-1957, 35mm Anamorphic Prints with Magnetic Sound Records, Usage in Projector.
PH22.109-1958, Dimensions for 16mm Motion-Picture Film, 1R-2994.
PH22.110-1958, Dimensions for 16mm Motion-Picture Film, 2R-2994.
PH22.112-1958, Picture-Sound Separation in 16mm Magnetic Sound Projectors.

upon the choice of available material or the intended use of the release print.

2.1.7 *Foreign Picture Release Negative.* A foreign picture release negative is a picture release negative prepared specifically for printing foreign version release prints.

Note: It is almost invariably a duplicate negative.

2.1.8 *16mm Picture Release Negative.* A 16mm picture release negative is a picture release negative on 16mm film prepared specifically for printing 16mm release prints.

3. Picture Positive Film Black-and-White and Color

3.1 *Picture Print.* A picture print is a processed film that possesses a positive picture image of the subject or film image to which it was exposed.

3.1.1 *Picture Daily Print.* A picture daily print is the first picture print made from the original picture negative for use in checking photographic quality, camera technique, actions, etc.

3.1.2 *Picture Work Print.* A picture work print is a positive print which usually consists of intercut picture daily prints, picture library prints, prints of dissolves, montages, titles, etc., and has synchronism constantly maintained with the corresponding sound work print.

3.1.3 *Picture Library Print.* A picture library print is a picture print made from a picture library negative.

3.1.4 *Background Plate (Background Print Film).* A background plate (background print film) is a picture print made specifically for use in projection background or similar process work, and is a print of a background plate negative.

3.1.5 *Picture Master Positive.* A picture master positive is a print usually made on a special film, for the purpose of producing picture duplicate negatives.

3.1.5.1 *35mm Separation Positive.* A 35mm separation positive is a black-and-white film with a positive image of the red, green or blue image component of a color negative. It is usually made by printing through suitable filters from a color negative onto a panchromatic black-and-white film.

3.1.5.2 *35mm Protection Master Positive.* A 35mm protection master positive film is a positive film made from the final cut and edited black-and-white or color release negative. In case of damage to the release negative, a duplicate negative could be made from this protection master positive. In the case of color, this protection master positive may be a set of three black-and-white separation master positives or a color master positive.

3.1.5.3 *35mm Panchromatic Master Positive.* A 35mm panchromatic master positive is a black-and-white print made on a panchromatic film from a color negative for the purpose of making a black-and-white duplicate negative.

3.2 *Composite Print.* A composite print is a positive film having both picture and corresponding sound on the same film which may be in editorial or projection synchronism.

3.2.1 *Composite Daily Print.* A composite daily print is made from an original composite negative or original sound and picture negatives, and is used for checking photography, sound quality, action, etc. It is in projection synchronism.

3.2.2 *First Trial Composite Print.* The first trial composite is the first composite print made from the picture and sound release negatives for the purpose of checking and correcting picture and sound quality, negative cutting and assembly, etc. It is in projection synchronism.

3.2.3 *Second, Third, Etc., Trial Composite Print.* The second, third, etc., trial composite print is similar to the first trial composite print, but has successive corrections incorporated as a result of viewing the previous trial composite prints.

3.2.4 *Final Trial Composite.* A final trial composite is a composite print, approved for release, in which all corrections found necessary in previous trial composite prints have been incorporated.

Note: The final trial composite may be any one of the various trial composite prints, depending upon the type and extent of corrections required.

3.2.5 *Composite Master Positive.* A composite master positive is a composite print usually made for the purpose of producing composite or picture and sound duplicate

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news and reports

Motion Picture Research Council Test Films

The test film program of the Motion Picture Research Council was transferred to the SMPTE following the Council's disbandment March 18 and will be conducted as part of the Society's test film activities.

Announcement of the dissolution of the MPRC (necessitated by a drastic retrenchment program of the Association of Motion Picture Producers) brought about a re-evaluation of its continuing projects, one of the most important of these being the test film program. Assumption by the Society of responsibility for the MPRC test films can properly be regarded as an extension of the Society's own test film program which has been in existence many years.

The MPRC was incorporated in 1947. Prior to that it had existed, in so far as purpose and activities were concerned, first as the Technical Bureau of the Academy of Motion Picture Arts and Sciences, organized in 1928, and from 1932 to 1947 as the Research Council. Of recent years it has received its main support from the AMPP.

Over the years it has worked closely with the SMPTE and a number of papers by MPRC authors, describing various phases of its activities, have been presented at Conventions and many of them later published in the *Journal*. A paper by W. F. Kelley and W. V. Wolfe on "Technical Activities of the Motion Picture Research Council," presenting a brief description of the (then) various programs and activities, was published in the February 1951 *Journal* (pp. 178–196). The most recent of the reports from Council members was a combined report by William F. Kelley and Walter Beyer, "Summarizing Reports on Statistical Data for Motion-Picture Research Council Theater Survey," and "Motion Picture Research Council's Contribution to Better Theater Projection," presented at the Society's 1959 Fall Convention in New York. These are planned for publication in the *Journal* in the near future.

William F. Kelley, who has been associated for many years with the MPRC, will serve as consultant to the expanded phase of the Society's test film program.

Scientific and Technical Awards

Seven Academy Awards were made this year in the Scientific or Technical category; five in Class II and two in Class III. Plaques were presented honoring achievements in the Class II division and a Certificate of Honorable Mention was presented to each of the Class III winners. In the order of presentation, Award recipients in Class II are:

Douglas G. Shearer of Metro-Goldwyn-Mayer and *Robert E. Gottschalk* of Panavision for developing a system of producing and exhibiting wide-film motion pictures known as Camera 65.

Wadsworth E. Pohl, William Evans, Werner Hopf, S. E. Howse, Thomas P. Dixon, Stanford Research Institute and *Technicolor Corp.* for the design and development of the Technicolor Electronic Printing Timer.

Wadsworth E. Pohl, Jack Alford, Henry Imus, Joseph Schmit, Paul Fassnacht, Al Lofquis and *Technicolor Corp.* for the development and practical application of equipment for wet printing.

Howard S. Coleman, A. Francis Turner, Howard S. Schroeder, James R. Benford and *Harold E. Rosenberger* of the Bausch & Lomb Optical Co. for the design and development of the Balcold Projection Mirror. This was the subject of a paper before the Society's Convention in Washington, D. C., in May, 1957. A current technical report, "A Commercial Cold Reflector," is in preparation for early publication in the *Journal*.

Robert P. Gutterman of General Kinetics Inc. and the Lipsner-Smith Corp. for the design and development of the CF-2 Ultrasonic Film Cleaner.

In Class III the Award recipients are: *Ub Iwerks* of Walt Disney Productions for the design of an improved optical printer for special effects and matte shots, and *E. L. Stones, Glen Robinson, Winfield Hubbard* and *Luther Newman* of the Metro-Goldwyn-Mayer Construction Dept. for the design of a multiple-cable remote-controlled winch.

Education, Industry News

More than three thousand art lovers in four cities — New York, Dallas, Los Angeles and Chicago — attended a televised auction sale where 50 works of art and $871,850 changed hands. Proceeds of the sale went to the Museum of Modern Art. The auction, broadcast over closed circuit, was held in the Parke-Bernet Galleries in New York. Special audio equipment installed by Theatre Network Television, Inc., brought out-of-town bids to New York and large viewing screens in other cities enabled the audiences to view the paintings and statues while listening to the auctioneer's comments. Top prices were paid for Cezanne's "Les Pommes" ($200,000) and a Braque ($145,000).

Construction of a new motion-picture theater in a Chicago suburb — the first to be built in that area for more than a decade — has been announced by Raymond J. Marks and Martin G. Rosenfield, owners of M & R Amusement Companies, 1777 Howard St., Chicago. Plans for the theater are based on what is called a "sawtooth" design. The height of the front of the building, according to the plans, would be 20 ft. The roof would follow ten step-ups to a height of 40 ft at the back. The building will be 223 ft long and 105 ft wide with seating space for an audience of 1700. The dimensions of the building will accommodate a screen 60 ft wide and 25 ft high. The theater will be constructed on a seven-acre lot which will include a parking area for 900 cars.

A new closed-circuit educational TV system has been installed at the University of California at Berkeley. It uses a Marconi Mark IV camera with a 4½-in. image orthicon for both closed-circuit and broadcast applications. This camera is being used in the broadcast of a series of lectures on physics over KQED-TV, Channel 9, San Francisco. With approximately 40 ft-c at a distance of 90 ft, using the 6½ to 40-in. range of a Super Universal Zoomar lens, excellent broadcast quality pictures are obtained with an *f*-stop setting between 8 and 11, according to Ken Winslow, Head of Educational Television, Department of Visual Communications. The camera is also used for closed-circuit classroom instruction, using available light under widely varying conditions.

The British Amateur Television Club extends an invitation to any and all SMPTE members who can be in London on Saturday, September 10, 1960, to visit the

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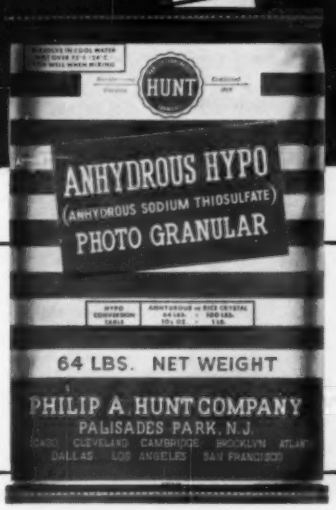

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Fifth Amateur Television Convention which will be held on that date in Conway Hall, Red Lion Square, London, W.C.1, from 10 A.M. to 7 P.M. Amateur-built television cameras will be in action and other amateur gear will be demonstrated. Particular emphasis will be laid on slow-scan television techniques. Secretary of the Club is Donald S. Reid, 149 Ongar Rd., Brentwood, Essex.

The 13th Annual Conference on Electrical Techniques in Medicine and Biology, scheduled for the Sheraton-Park Hotel, Washington, D. C., Oct. 31 – Nov. 2, will feature a diversified program on biomedical electronics, with emphasis on analytical techniques. Subject areas include (1) General: Flowmetering, Ultrasonic Mapping, Densitometry, Electrophoresis, Mass Spectroscopy, Microwave Spectroscopy; (2) Electroanalytical Techniques: Polarography, Specific Electrodes, Coulometry, Titrant Generators; (3) Waveform Interpretation: Heart Sounds, Nerve and Muscle Potentials, Cardiovascular Pressure; (4) Cell and Particle Counting and Sorting; (5) Analogs; (6) Automated Analytical Methods; and (7) Physiological Monitoring: Patients, Astronauts, etc. As in the past, this meeting will be sponsored by the Joint Executive Committee in Medicine and Biology representing the Institute of Radio Engineers, American Institute of Electrical Engineers and the Instrument Society of America.

The First International Congress on Medical Photography and Cinematography will not take place in Cologne as previously announced (*Journal*, p. 208, Mar. 1960) but will meet in Düsseldorf (Ehrenhof/Exhibition Ground). The original plans were changed when it became apparent that hotel reservations for prospective visitors to the Photokina were far surpassing expectations, so in order to assure satisfactory accommodations to delegates and visitors to the Congress the meeting place was changed to Düsseldorf.

Photokina 1960 (Sept. 24 – Oct. 2, Cologne, Germany) is expected to surpass in exhibits and attendance all such meetings held previously. Nine halls with a combined display area of 720,000 sq ft will be available for exhibits. A brief report on the industrial situation in West Germany, presented in connection with information on the Photokina, shows that combined sales of all types of photographic equipment, including projectors, increased 13% in 1959 over the 1958 total.

Television Engineering in Science, Industry and Broadcasting was the theme of the Convention of the British Institution of Radio Engineers, held last July 1–5 at the University of Cambridge. The Clerk Maxwell Memorial Lecture, since 1951 an annual feature of the British IRE's Conventions, was delivered by Dr. Vladimir K. Zworykin.

The overall covering of subjects is large. Titles and authors of the papers presented during the Convention were:

"Industrial Television: A Survey of History, Requirements and Applications," by J. E. H. Brace, Marconi's Wireless Telegraph Co. Ltd.

"Technical Considerations of Television in the International Field," by T. Kilvington, Post Office Engineering Dept.

"A Common Carrier Multi-Channel Television Relay System," by K. A. Russell and F. Sanchez, British Relay Wireless Ltd.

"Some Aspects of the Design of Small Television Stations," by Aubrey Harris, Ampex Corp.

"Subception," by N. F. Dixon, University College, London.

"Reduction of Television Bandwidth by Frequency Interlace," by E. A. Howson and D. A. Bell, University of Birmingham.

"The Plated Circuit in the Large Scale Production of Television Receivers," by W. I. Flack, Radio and Allied Industries Ltd.

"Some Aspects of Mechanization in the Radio and Television Industry," by F. Packwood, Philips Croydon Works Ltd.

"Production Soldering Methods With Particular Reference to Flammability Characteristics," by D. W. Heightman, Mains Radio Gramophones Ltd.

"Printed Circuit Production for a Television Tuner," by P. C. Ganderton, Sydney S. Bird & Sons Ltd.

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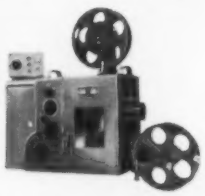

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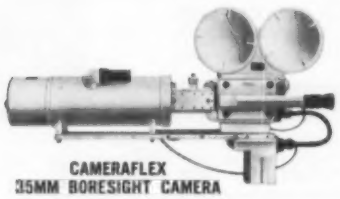

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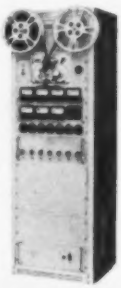

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"The Application of Printed Wiring to Development and Small Batch Production With Particular Reference to Television Equipment," by E. Davies.

"The Combined Television-Radio Receiver and Its Problems," by R. S. Hildersley, Murphy Radio Ltd.

"Assessment of X-Radiation From TV Receivers," by A. Ciuciura, Mullard Radio Valve Co. Ltd.

"Design of Dual-Standard Television Receivers for the French and C.C.I.R. Television Systems," by C. J. Hall, Pye Ltd.

"Television Reception on Band V," by H. N. Gant, E.M.I. Electronics Ltd.

"Time-Base Synchronization and Associated Problems," by P. L. Mothersole, Mullard Research Laboratories.

"Good Practice Techniques in Television Scanning Circuits," by K. E. Martin, Mullard Research Laboratories.

"Television Field Scan Linearization," by H. D. Kitchin, Mains Radio Gramophones Ltd.

"Arguments for and Against the Full Restoration of the D.C. Component With Special Reference to Mean Level Automatic Gain Control," by Dr. E. L. C. White, E.M.I. Electronics Ltd., and S. N. Watson, B.B.C. (for); and J. Gifford, Kolster-Brandes Ltd. (against).

"Transistors in Video Equipment," by P. B. Helsdon, Marconi's Wireless Telegraph Co. Ltd.

"A Transductor Regulator for Stabilized Power Supplies," by A. N. Heightman, Marconi's Wireless Telegraph Co. Ltd.

"The Testing and Operation of the 4½-in. Image Orthicon Tube," by D. C. Brothers, BBC.

"Some Aspects of Vidicon Performance," by H. G. Lubszynski, J. Wardley and S. Taylor, E.M.I. Ltd.

"A Television Master Switcher," by B. Marsden, Associated Television Ltd.

"Communications in Independent Television," by L. F. Mathews, Associated Television Ltd.

"Automation of Television Programme Switching," by G. E. Partington, Marconi's Wireless Telegraph Co. Ltd.

"Industrial Video Magnetic Recording and Playing Machine," by J. Elliot, E.M.I. Ltd.

"Recent Developments in Video Tape Recording," by C. P. Ginsburg, Ampex Corp.

"Operational Facilities in the R.C.A. Colour Television Tape Recorder," by A. H. Lind, Radio Corp. of America.

"A Mobile Television Camera and Recording Vehicle," by Aubrey Harris, Ampex Corp.

"The Development and Progress of Medical Colour Television," by Brigadier R. D. Ambrose and A. R. Stanley, Smith, Kline & French Laboratories Ltd.

"A Gating Circuit for Single-Gun Colour Television Tubes," by K. G. Freeman, Mullard Research Laboratories.

"A Medium Screen Colour Projector," by Thomas M. C. Lance, Rank Cintel Ltd.

"Methods of Performance Measurement on Colour Television Receivers," by A. J. Biggs and E. Ribchester, General Electric Co. Ltd.

"Photo-Electric Image Techniques in Astronomy," by B. V. Somes-Charlton, High Definition Television Ltd.

"Design Techniques for Space Television," by A. J. Viterbi, California Institute of Technology.

"The Use of Television for the Microscopical Examination of Radioactive Metals," by E. C. Sykes, U.K. Atomic Energy Authority.

"Phosphors for Use in Cathode Ray Tubes in Industrial and Low Speed Display Scanning Systems," by M. D. Dudley, Ferranti Ltd.

"A Two-Way, Closed Circuit Facsimile System," by R. W. Elbourn, Decca Radar Ltd.

"The Application of Closed Circuit Television in the Nuclear Industry," by P. Barratt and I. M. Waters, Pye Ltd.

"A High-Grade Industrial Television Channel With Reference to Infra-Red Operation," by J. H. Taylor, E.M.I. Electronics Ltd.

"An X-Ray Image Amplifier Using an Image Orthicon Camera Tube," by E. Garthwaite and D. G. Haley, Marconi Instruments Ltd.

"Gap Filling Television Transmitter," by W. J. Morcom, Marconi's Wireless Telegraph Co. Ltd.

"Transmitting Aerials for Television Broadcasting in the United Kingdom," by A. Brown, BBC.

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"A Mobile Microwave Link for Outside Broadcasting," by J. P. Polonsky, Compagnie Generale de T.S.F.

"Some Aspects of Television Transmission Over Long Distance Cable Links," by H. Mumford, British Telecommunications Research Ltd.

"Waveform Distortion in Television Links," by I. F. Macdiarmid, Post Office Research Station.

"Video Frequency Equipment for Television Centers of the Soviet Union," by B. A. Berlin, State Committee for Radio Electronics, Moscow.

"Application of Television in Industry and Science," V. I. Sardyko, State Committee for Radio Electronics, Moscow.

"Television Set Production in the U.S.S.R.," by A. Y. Bratebart, State Committee for Radio Electronics, Moscow.

"Sync Signal Regeneration System for Low-Power Translators," by P. K. Kirilloff, State Committee for Radio Electronics, Moscow.

"Motion Picture Facsimile Equipment," by S. N. Watson, BBC.

All papers read at the Convention will be found in subsequent issues of the Institution's Journal. A limited number of preprints have been listed as still available. Further information may be had by writing to the General Secretary, The British Institution of Radio Engineers, 9 Bedford Square, London W.C.1.

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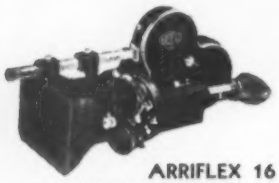

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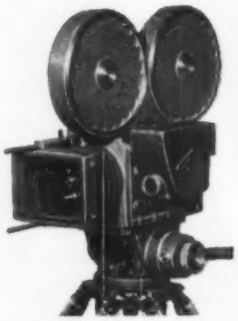

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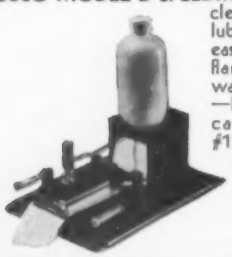

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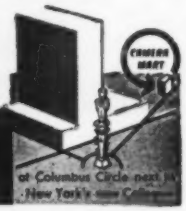

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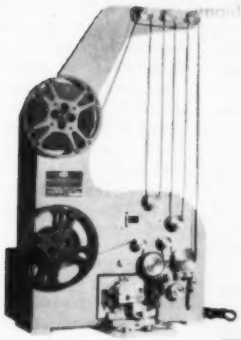
Theater design is included in the categories for recent awards totaling about $395,000 to "talented persons from several branches of the arts to deepen their experience in the legitimate and lyric theater," announced by the Ford Foundation. Four categories of theatrical activity were thus honored: Theater Designers and Architects; Poets and Fiction Writers; Theater Directors, and Playwrights. Thirty-two awards were made, selected from about 900 nominations made by artists, critics and others prominent in the theatrical field.

In the Theater Design category awards were made to teams of architects and designers. One such award was made to Ben Schlanger, architect, and Donald Oenslager, designer. Their joint project is the efficiency study and design of a theater form-and-space concept in the proscenium, and of a non-proscenium technique producing a maximum number of desirable viewing positions. Mr. Schlanger is a Fellow of the Society and the author of a number of papers published in the *Journal* on various subjects related to motion-picture theater exhibition.

Music in Williamsburg, a recently completed color film, is the first film to be made specifically for television under the Colonial Williamsburg program. The film was directed by Sidney Meyers. The production staff included Robert Ziller, cameraman; Alan Lomax, folk music consultant; and Gene Forrell, music arranger. The motion picture was produced by Arthur L. Smith with Stan Croner as writer and associate producer.

Nearly 700 research projects were carried on during the fiscal year 1958–1959 by the staff of the Armour Research Foundation of Illinois Institute of Technology, according to the Foundation's Annual Report for 1959, which presents highlights and a brief evaluation of typical studies completed or continuing during the year. Main areas of research are in Ceramics; Chemistry; Electronics; Engineering Economics; International; Mechanics; Metals; Physics, and Fluid Dynamics and Systems. Some interesting studies in the Physics Research Division in the field of optics include theoretical and practical aspects of a high-resolution cathode-ray tube using fiber optics; basic studies of diffraction, frustrated total reflection, and information transfer in fiber optics; deterioration of photographic resolution caused by aerodynamical conditions — emission, shock wave, laminar and turbulent boundary layer, etc., — around a hypersonic vehicle. Studies of image quality in an infrared missile guidance system were conducted, resulting in new techniques for a measurement of image degradation.

In addition to research the Foundation conducts licensing operations. In the field of magnetic recording it has continued its studies on increasing information density with emphasis on the use of thin ferro magnetic film for the recording medium. An interesting Hall-effect magnetic playback head was developed. Research in the devices for video recording has led to developments still in the initial stages.



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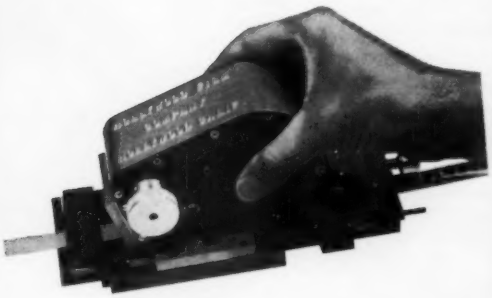

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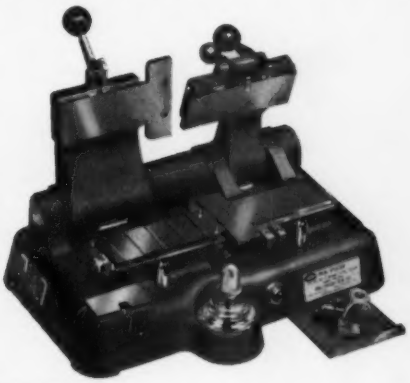
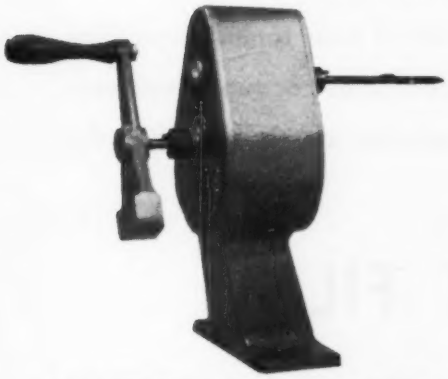


HOT SPLICERS



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Twenty-four magnetic recording patents were issued during the year bringing the total number to more than 275 owned by the Foundation.

Telephone-television with all of its intriguing possibilities is here — and quite likely to stay. Demonstrated at the Institute of Radio Engineers Show in the New York Coliseum, March 21–24, Telectrovision, a system which transmits still television pictures over ordinary telephone lines may be of practical value in various industrial and military applications. The system has been developed by Telectro Industries Corp. of Long Island City, manufacturer of magnetic tape equipment. Company representatives said that it was expected that the first unit would be sold to the Air Force for use in its weather radar system. Other suggested applications include use in banks, for identifying signatures and other data, and news services. In describing the device, company representatives said that still pictures can be sent along telephone lines for any distance. It was said that the picture can be stored for later viewing or a permanent copy can be made.

The theater screen advertising division of Reid H. Ray Film Industries, Inc. has been acquired by Alexander Film Co., Colorado Springs, according to an announcement issued jointly by Keith Munroe, President of Alexander Film Co., and Reid H. Ray. The Reid H. Ray Film Industries is continuing its major activity, the production and distribution work in commercial, documentary, sales and government training films. The Alexander Film Co. maintains an 18-acre studio city at Colorado Springs with facilities for production and world-wide distribution of theater screen advertising, TV commercials and longer films.

Research activities of Bell & Howell Co. of Chicago and its California subsidiary, Consolidated Electrodynamics Corp. (CEC) have been combined into a single, expanded research division located in Pasadena, Calif. Head of the new division is Philip S. Fogg, President of CEC. Charles F. Robinson has been appointed Director of Research, John G. Heiland is Associate Director, and Kenneth W. Gardiner is Assistant Director. Prior to his present appointment, Dr. Robinson was Associate Director of Research at CEC. Mr. Heiland, who has been with Bell & Howell in Chicago for 17 years, has directed the firm's research activities since 1955. Mr. Gardiner was formerly chief research chemist at CEC.

Radio Corp. of America has created a new department called RCA Electronic Recording Products Department. Magnetic recording devices for application in various fields, including business data processing, TV broadcasting, remote control telemetering and space instrumentation, will be within the province of the new department. At its head is M. A. Trainer who joined the company in 1930 and contributed greatly to the development program which led to the all-electronic television system. He has been serving as Manager of Market Development for the RCA Broadcast and Television Equipment Division. Jerome L. Grever has been appointed Market Manager for the new department and Henry H. Klerx is Merchandising Manager. A. H. Lind will be in charge of engineering activities and G. F. Rester has been appointed Sales Manager.

Formation of a new firm in the electro-acoustical and electro-mechanical fields, Vega Electronics Corp., Cupertino, Calif., has been announced by Russel J. Tinkham, President. The new firm is particularly interested in precision digital and analog magnetic recording equipment. Other officers and key employees of the new firm are Walter C. Hironimus, Vice-President and Chief Engineer; C. Arthur Foy, Marketing Manager; and Robert Z. Langevin, Francis A. Dicus, Ralph L. Brown, Roger S. French and William E. Magnie. Each of the officers and employees named above has been associated with Ampex Corp. for several years.

The Warren Conrad Portman Co. has been purchased by a newly organized firm, Photo Animation, Inc., 34 West St. So., Mt. Vernon, N.Y. President of the new firm is Warren C. Portman and the Vice-President is William H. Hernstadt. The new firm will manufacture Portman

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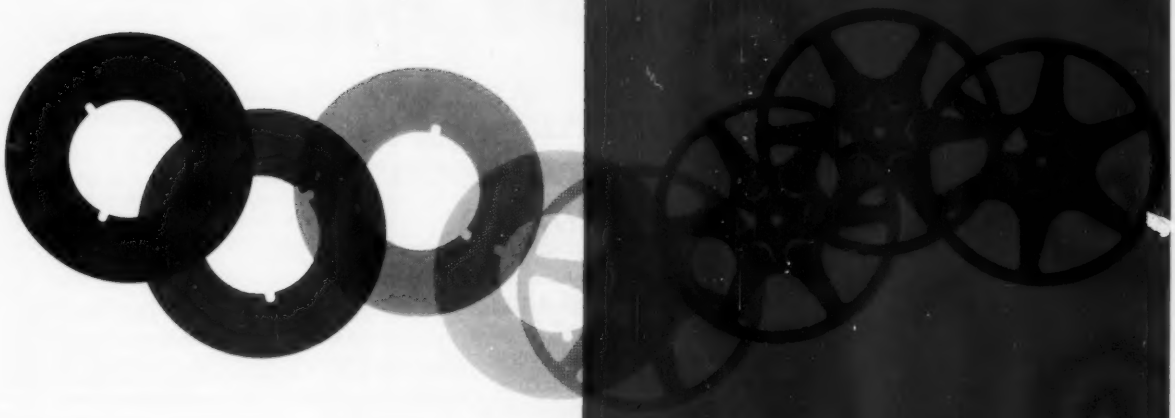

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and Triplex animation stands and will also manufacture other photographic equipment.

A new consulting service on high-speed instrumentation has been announced by Beckman & Whitley, Inc., San Carlos, Calif. Head of the new service is Peter J. Van Zandvoord, formerly in charge of the photographic laboratory of the Wollensak Optical Co., Rochester, N.Y. Organized primarily around applications of Dynafax and Magnifax Cameras, the consulting service includes taking personnel and equipment to the customer's plant. This service makes available analytical applications at rates from 200 to 26,000 frames/sec. Charges are presently being based on $200 per day for Dynafax and $100 per day for Magnifax.

A worldwide film production consultation service has been announced by Florman & Babb, Inc., 68 W. 45 St., New York 36. Countries already visited by Arthur Florman on behalf of the firm to study production facilities include Netherlands, Great Britian, Canada, Denmark, Italy, Germany, Venezuela, Haiti, Panama and Nassau. Later this year the survey will be extended to include Japan, Philippines, Thailand, Pakistan, Israel, Turkey and Greece. Inquiries from independent producers and government agencies throughout the world will be welcomed.

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An expansion program which includes construction of a chemical manufacturing plant and general offices has been announced by Philip A. Hunt Co., Palisades Park, N.J. The new building is now under construction. The company moved from New York City to Palisades Park in 1948 and has a total of five manufacturing centers and nine warehouses.

The Hollywood Film Co., 956 Seward St., Hollywood 36, has announced plans to open a branch office in Chicago. The new branch will occupy an area of 10,000 sq ft providing for offices, warehouse and showroom. In addition to the home office in Hollywood, the company presently maintains a branch office in New York.

Camera Equipment Co. of New York has announced the opening of a new sales office and warehouse at 6510 Santa Monica Blvd., Hollywood. The warehouse will carry the full range of equipment presently available at the company's New York headquarters and at its Miami branch. Manager of the new office is Jack Pill.

The Editorial Office of the *American Journal of Physics*, the official publication of the American Association of Physics Teachers, has been moved to Bryn Mawr College, Bryn Mawr, Pa., it was announced by the Editor, Walter C. Michels. It will continue to be published by the American Institute of Physics, 335 East 45 St., New York 17.

Emmett R. Salzberg and David M. Goodman are inventors of an automatic telephone answering device called the Teller, which combines a conventional telephone with a transistorized tape recorder. The answering and recording features of the device are integrated with a standard telephone set without increasing the overall dimensions by more than 2 in. The automatic answering and message recording device does not interefere with ordinary use of the telephone. A turn of the switch can set the answering and message recording device in operation or return the telephone to ordinary use. Unlike attachment-type answering devices, the Teller provides for dual use of the telephone by integrating the handpiece, dial assembly, and ringer of the ordinary telephone with answering components which include only a single motor, two transistor amplifiers, an endless loop of recording tape, three stationary magnetic heads, and three switches. The device is the subject of U.S. Patent 2,928,898, March 15, 1960, issued to SMPTE Member E. R. Salzberg, et al.

The appointment of Alexis Badmaieff to the post of Chief Engineer, acoustics-transducers, has been announced by Altec Lansing Corp., 1515 South Manchester, Anaheim, Calif. He was formerly President of Ultra-Fidelity Labs., Inc. Announcement was also made of the appointment of William H. Johnson to the post of Manager of the Engineering and Technical Information Dept. Two promotions in the Peerless Electrical Products division were announced, that of Ercell

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CLEANS your film and tape

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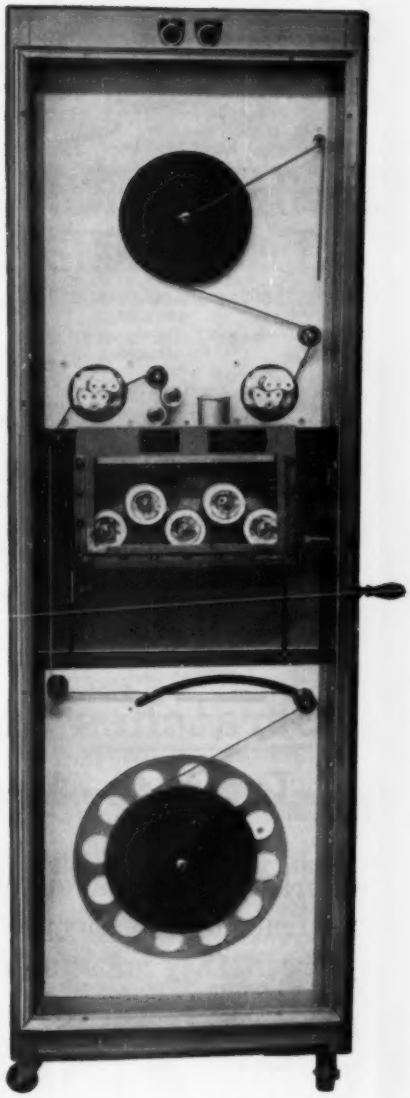

All you have to do is put the film in place and fill the solvent tank. The new Unicorn cleaner does the rest automatically—and speedily with all scrubbing action taking place below the solvent level. It effectively cleans motion picture films (negative and positive) and magnetic tape at rates to 300 feet per minute with complete safety. Cleaning is accomplished by counter-rotating velvet covered scrubbing rollers, effectively removing dirt, lint, oil, fingerprints and wax.

The Model A-5100 is a combination 16/35 mm film cleaner. Other cleaners are available for 16 mm film only, 35 mm film only and for 70 mm film only. All models include these special features:

COMPLETELY SELF-CONTAINED. *No vacuum pump or outside sources of air are required. The Unicorn cleaner is complete in itself.*

FLUID CUSHION PROTECTS FILM. *The fluid solvent forms a barrier between the scrubbing roller and film to prevent scratches and abrasions. Only velvet fibres lightly touch the film.*

SPEED CONTROL. *Operate at any speed from 0 to 300 feet per minute with adjustable speed control. Automatic shut-off leaves unit threaded for continuous operation.*

COMPLETELY SAFE. *Uses only non-inflammable, non-explosive solvents. Fumes controlled. Automatic shut-off in case of defective splices.*

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LOW COST OPERATION. *Solvents are continuously filtered and reclaimed; waste held to minimum. One pint of solvent cleans 3,000 feet of 35 mm film.*

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B. Harrison to General Manager and that of James M. Farrell, formerly Traffic Manager of Altec, to the post of Plant Manager at Peerless.

Walter G. Eggers has been appointed Vice-President of Movielab Color Corp., a Division of Movielab Film Laboratories, Inc. He has been engaged in motion-picture laboratory work for 23 years and has been in charge of black-and-white and color quality control at Movielab since 1954.

Hayes G. Shimp, Inc., has been appointed manufacturer's sales representative for The Tintometer Ltd. of Salisbury, England, manufacturer of The Lovibond Color Scale and visual color measuring instruments. The firm has also appointed Hayes G. Shimp, Jr., as its technical representative in the United States.

Charles R. Burrows has been named Vice-President and Director of Research and Development for Page Communications Engineers, Inc., a subsidiary of Northrop Corp. Prior to his present appointment he was Vice-President of Engineering for Radiation, Inc., Melbourne, Fla. Earlier, he was Vice-President of Engineering for the Ford Instrument Company Division of the Sperry Rand Corporation. For eleven years he was Professor of Electrical Engineering and Director of the School of Electrical Engineering at Cornell University and for 21 years he was a member of the technical staff of Bell Telephone Laboratories where he specialized in advanced electronics research. In his present post, Dr. Burrows will be responsible for the technical administration of the firm's space and satellite communication projects, and continuing research in the fields of radio relay systems, navigational techniques and wave propagation.

Adron M. Miller has been appointed Manager of the newly established RCA Film Recording and Television Systems Center at 1560 N. Vine St., Hollywood. He has been with RCA since 1951 when he was field representative for Mobile and Microwave Communications. In 1955 he became Manager of Radio Equipment Field Sales, with headquarters at Camden, N.J., and in 1959 he was appointed Southern Field Sales Manager, Broadcast and Television Equipment. The new Center will supply services to producers in the Los Angeles area ranging from engineering assistance to systems planning.

John J. Kowalak has been elected Vice-President of Movielab Color Corp., a subsidiary of Movielab Film Laboratories, Inc. He joined Movielab in 1957 as Color Consultant in charge of Chemistry and Color Processing. He was formerly associated with Ansco Films.

Lawrence Weiland has been appointed staff assistant to Charles Ginsburg, manager of video engineering for Ampex Professional Products Co., Redwood City, Calif. Prior to this appointment he was manager of advanced planning for engineering for National Broadcasting Co., New York. Further changes are scheduled for June 1, when Mr. Ginsburg will become manager of advanced video development and Mr. Weiland will become manager of video engineering.

New appointments in the Instrument Division have been announced by Beckman & Whitley, Inc., San Carlos, Calif. Robert D. Shoberg has been appointed Manager of Camera Products. Prior to this appointment he was in charge of marketing for Dynafax and Magnifax cameras. George Bingham has been appointed Assistant to Joseph R. Greer, Manager. Frank Provost, who handles field applications engineering for the Eastern area of the United States, with headquarters in Mahopac, N.Y., will report to Bob Shoberg.

Gerhard Lessman has been appointed Director of Advance Development of Bell & Howell. He has been Associate Director of Research for the firm since 1955. He was formerly associated with the DeVry Corp. as Chief Optical Engineer.

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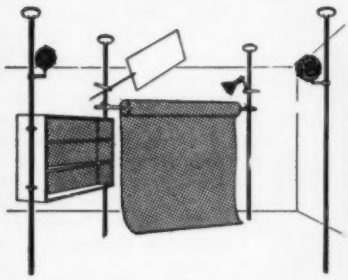

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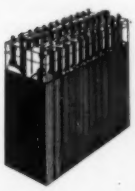

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Obituaries

Al Young died March 1, 1960, in Miami, at the age of 65. He was President of Du Art Film Laboratories, Inc., and Tri Art Color Corp., New York, and Associated Screen Industries, Ltd., Montreal, Canada. A native of New York, he was educated in the city's schools. Early in his career he went to California where, in 1915, he entered the motion-picture industry as film editor. In 1922, after returning to New York, he became one of the founders of Du Art and by 1949 he was President and sole owner of the firm.

Jay E. Gordon, 44, died March 17, 1960, in an automobile accident on the Santa Ana Freeway in California. He was General Supervisor of Motion Pictures for Autonetics, a division of North American Aviation, Downey, Calif. Born in Northport, Washington, May 21, 1916, he was graduated from the College of Marin with an Associate of Arts degree in 1939. A short time later he became Editor of *Hollywood Spectator*, a magazine of film criticism. From 1941 to 1950 he served as Visual Aids Coordinator and then as Audio-Visual Director of Headquarters, 6th U.S. Army, San Francisco, and was decorated with the Exceptional Civilian Service Medal. After serving as a film producer for the U.S. Navy from 1952 to 1955, he became a producer-director-writer with the Missile and Control Equipment organization of North American Aviation After the organization was made into four divisions he became Supervisor of Motion Pictures for Autonetics and, in 1959, was made General Supervisor. A number of distinguished films have been made under his supervision, including *Origins of the Motion Picture; Engineering for Tomorrow*, and *Nautilus Arctic Passage*.

A member of the Society, other affiliations include Edison Pioneers, Thomas Alva Edison Foundation, and Industry Film Producers Association. He was also West Coast Regional Director of the Industrial Audio-Visual Association.

Don Bennett, Editor of *PSA Journal*, died April 6 in Stamford, Conn. He was born in 1903 and began his career in photography at an early age with the production of a number of amateur motion pictures, and during the years had many professional motion pictures to his credit. He was formerly Chief of the Motion-Picture Division, Department of Visual Aids and Education, Department of Agriculture, and in 1939 one of his films, *Poultry, A Billion Dollar Industry*, won the Grand Prix in Rome. He also conducted classes in photography at Cornell University and, from 1933 through 1935, he taught classes in the motion picture at New York Institute. He had also served as an electronics technician for Shappe-Wilkes, Inc., advertising agency. During 1939-1940 he edited *Photonews Weekly*, the first weekly publication in photography, and in 1941 he became Associate Editor of *Photo Dealer*, a post he held until 1952 when he became Editor of *PSA Journal*. He was a member of this Society and a Fellow of the Photographic Society of America.

section reports

The Atlanta Section met on April 19 at Lockheed Aircraft Corp., Marietta, Ga., with an attendance of 26.

There were no guest speakers at this meeting. The program consisted of three films showing typical examples of in-plant productions. These films were: *Nautilus Arctic Passage*, by the Autonetics Division of North American Aviation. This film was a documentary account of the voyage of the Nautilus under the polar ice cap. *The Big Reach*, by Douglas Aircraft told the story of the first attempts by the Air Force to reach the moon. Lockheed's *The Big Stick*, showed the use of the company's C-130 (Hercules) transport planes on a hypothetical mission of a military transport group.

In addition to the interesting content of the films, they demonstrated to the discerning professional observer some very ingenious solutions to extremely difficult film production problems.

Coffee and coffee cake were served during a social period after the meeting. Members and guests were invited to tour Lockheed's film production facilities and to inspect the equipment — Wesley R. Sandell, *Secretary-Treasurer*, c/o Kodak Processing Laboratory, 4729 Miller Dr., Chamblee, Ga.

The Hollywood Section met on April 19 at ABC Studio A with an attendance of 115. Guest speakers were Richard DeLancie, President of Broadview Research Corp., Washington, D.C., who discussed "Aerial Photography and Spectrophotometry"; and James R. Chadwick of Chadwick-Helmuth Co., Monrovia, Calif., whose topic was "A New Technique for High Speed Photography of Cyclic Events."

Mr. DeLancie described techniques recently developed in black-and-white aerial photography and spectrophotometry whereby tone contrast resulting from various types of earth surface materials can be enhanced and tailored to specific investigations, both military and commercial. Construction of unique laboratory and portable spectrophotometers capable of analyzing reflective characteristics of vegetation, rocks, and earth has enabled this company to develop a practical and successful method of analysis and detection.

According to Mr. Chadwick, Chadwick-Helmuth has devised electronic circuitry and a pulse camera utilizing "strobe" lights to photograph cyclic events such as equipment environmental vibration tests. By means of a "slip sync" electronic control device, the phase of the strobe light excitation may be continuously varied to provide a visual slow-motion presentation of fast, recurrent events. Pulse camera photography at the rate of 24 to 30 frames/sec provides a permanent record of component vibrational patterns throughout

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the continuously variable frequency range of the tests. Economy of film consumption is achieved as well as direct visual examination of the vibration during test and photography.—Ralph E. Lovell, *Secretary-Treasurer*, 2554 Prosser Ave., Los Angeles 64.

The New York Section met on April 6 at the World Affairs Center Auditorium with an attendance of 68. Guest speakers Fred G. Beach, Manager, Visual Aids Department, Remington Rand Div., Sperry Rand Corp., and J. L. Siegal, Manager, Films & TV News Activities, International Business Machines Corp., discussed "Motion Picture Films in Industry."

Mr. Beach began the session with a short talk covering the proper choice of the medium to be used to convey the desired idea or function to an audience. Illustrating his talk with a humorous film showing the problems of an industrial film producer, Mr. Beach stated that in many cases a slidefilm would be preferable to a motion picture for presentation of a particular subject.

Mr. Siegal discussed the various distribution channels used by his department to utilize best the motion-picture and television facilities of IBM. He illustrated his discussion with a showing of two motion-picture news releases and showed several kinescopes of closed-circuit television briefing sessions used to convey technical information between widely separated departments.—James W. Kaylor, *Secretary Treasurer*, c/o Movielab Film Laboratories, Inc., 619 W. 54 St., New York 19.

The Rochester Section met on March 17 at Greece Olympic High School with an attendance of 59. Donald Haefele, the Vice-Principal, was guest speaker and discussed "Audio-Visual Aids in a Modern School System." He demonstrated equipment used in the school's Audio-Visual Department. Quite a variety of projectors and other aids were shown and a description given of the Language Department which is quite modern and probably the best equipped in the City of Rochester.

The Board of Governors of the Section met prior to the meeting. A program was finalized for the joint meeting with the Student Section at Rochester Institute of Technology which will be held during May. Several members of the Board of Governors and their friends attended a dinner get-together before the meeting.

This meeting was an important one to us in that it was held in a remote area of the city. We were elated to see that our attendance was good at this meeting.—Wilbur G. Hill, *Secretary-Treasurer*, 10 Hillcrest Ave., Binghamton, N.Y.

The Rochester Section met on April 13 at TV Station WHEC with an attendance of 51. Main speakers, E. P. Genock, Manager, TV Programming, Eastman Kodak Co., and J. G. Stott, Assistant Manager, TV Programming, Eastman Kodak Co., in a discussion on "How Film and Audience Rate on TV," explained that the measure of effectiveness of TV programing, may be accomplished in several ways and can be interpreted for various purposes. How the rating is done, in general, is determined by customers' needs. Each rating by itself provides valuable information indicating that ratings serve as a basis of study of the economies of programing. Data from ratings can help to promote, when used properly, "freedom of taste." Ratings, however, can be and often are misinterpreted by the press, the speakers agreed.

Consistently good TV showing of films can be continued by exercising proper controls, Mr. Stott said. The problem of film damage, still present, is being alleviated. Special films for TV are available but best results can be obtained only if spot brightness meters are used and the illumination brightness range controlled to suitable values. Printing of "released" films for TV reproduction must be according to specifications for the best results.

Prior to the meeting, officers and guests met for an informal social hour and dinner.—Wilbur G. Hill, *Secretary-Treasurer*, 10 Hillcrest Ave., Binghamton, N.Y.

The San Francisco Section met on April 12 at the Studios of KGO-TV with an attendance of 24 to hear a discussion and see a demonstration of extreme environment TV systems. The main speaker of the evening was Charles M. Aker, Director of Engineering, Industrial Products Division, International Telephone and Telegraph Co., San Fernando, Calif.

Mr. Aker discussed three of I.T.&T.'s basic vidicon cameras. With the aid of slides, he talked about the model CM-30 vidicon camera and its control unit and monitoring systems. One of these cameras was in operation and focused on the audience so that they might observe themselves during the discussion. The second camera, which was described, was designed to operate under extreme noise and/or shock conditions. Several typical operating conditions were discussed and comparisons made with standard vidicon cameras, showing where failure of the standard would occur. The third system, recently made public, is designed to operate in radioactive fields. It was shown that standard vidicon cameras with standard lenses would cease to operate after a short period in a field of 1 by 10^6 roentgen, while I.T.&T.'s radiation camera with its special shielding sapphire-faced vidicons and pure quartz lenses would operate for an extended period in a field of 1 by 10^{18} roentgen. This intense field of radioactivity would be found approximately 1½ ft from a radioactive field.

A lively question and answer period followed the discussion.—Frank Mansfield, *Secretary-Treasurer*, 57 Stoneyford Ave., San Francisco 24.

The Washington Section met on March 30 at the National Academy of Science with an attendance of 50. Guest speakers at the meeting were Charles Austin, of Mitchell Camera Corp., New York, and Walter Hicks of Reevesound Company, Inc., Long Island City, N.Y.

This meeting, at which two original papers on new developments were presented, was opened with a film presentation, "The Cinematographer."

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video tape
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crab dolly
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In his discussion of the new Mitchell R-35 Studio Reflex Camera, Mr. Austin indicated that the R-35 combines many of the standard features plus continuous reflex focusing. The reflecting and focal plane shutters are arranged to prevent fogging when the cinematographer's eye is not over the eyepiece. The camera will accommodate 100 or 200-ft daylight loading spools and 400-ft darkroom loads. Other magazines will take up to 2000 ft. Essentially, the new camera will be for studio use, tripod mounted. Because it is designed for portability, the R-35 can be used successfully without a tripod. The new magazine is mounted to the rear and under the camera in such a way that it will fit against the operator's shoulder. With the new camera it is possible to dolly continuously from a long shot to an extreme close-up. Accessories, such as additional motors, remote control focusing, etc., will be available. A new series of lenses was designed especially for this camera by Bausch & Lomb.

Prior to the delivery of Mr. Hicks' paper on "The Reevesound Baby Recorder," a film, *The Sound Man*, was shown. The Reevesound Baby Recorder is a new concept in sound recording, according to Mr. Hicks. One-quarter-inch perforated magnetic tape is used in the recorder which is mounted on the camera magazine. A film sprocket replaces one of the rollers in the camera magazine. The film which is threaded through the sprocket in the light-trap drives the tape transport mechanism. The recorder can be quickly and easily moved from one modified film magazine to another. Microphone, monitoring headset, transistorized record and playback amplifiers and recorder weigh approximately eight pounds and can be carried in a standard attache case. Monitoring can be either direct or from the recorded tape. With this system frame-to-frame synchronous sound with no elaborate control system can be recorded.

Both films shown at this meeting were made about 10 years ago by the Research Council of the Academy of Motion Picture Arts and Sciences for the members of the motion-picture industry. We used the films in this instance as reference materials for our guests and those of our members who do not work in the particular fields under discussion. It is part of our determined effort to make our programs understood by anyone who comes either as a guest or as an interested member. Thus far, this approach has proved to be an effective one.

Because of the very large amount of motion-picture and television equipment purchased and used here and elsewhere by the Federal and local government, we are inviting those people who are concerned with the various phases of purchasing, etc., to attend our meetings.—William E. Youngs, *Secretary Treasurer*, 231 Mayflower Dr., McLean, Va.

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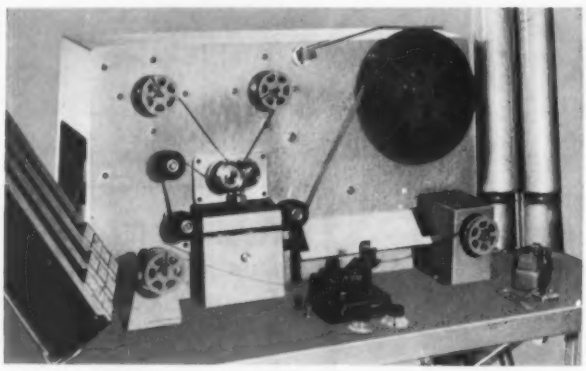

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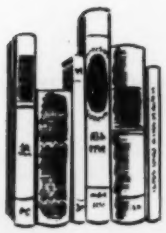

books reviewed

The Audio Cyclopedia

By Howard M. Tremaine. Published (1959) by Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis 6, Ind. v-ix + 1269 pp. including illus. (354 halftones, 1300 line drawings, charts, graphs, etc.). 6 by 9-in. Price $19.95.

This book was developed from a series of lectures by the author on high-fidelity sound systems. It is primarily intended for technicians and engineers involved in any of the phases of the recording and reproducing of sound.

Its extraordinarily wide gamut of subject material, nearly all of it discussed in very close detail, represents an unusual accomplishment for a single author, and testifies to his broad range of interests.

The book contains 26 chapters (called "sections"), each discussing some phase of the subject. A few sample titles are Acoustics and Studio Techniques; Microphones; Equalizers; Wave Filters; Vacuum Tubes, Transistors and Diodes; Audio Amplifiers; Disc Recording; Magnetic Recording; Optical Film Recording; Motion Picture Projection Equipment; Power Supplies; Test Equipment; Audio-Frequency Measurements; Installation Techniques; etc.

The format used consists entirely of specific questions and answers, which gives a slightly colloquial flavor to the text. There are over 3400 such questions and answers. An engineer might possibly feel that the constant repetition of "What is. . . .?", "How is . . .?", "What determines . . . .?", "Show the . . . .", etc., adds very little to the presentation.

Two examples taken at random may be given of some of the subject matter. A 14-page chapter of 41 questions is devoted to VU and volume indicating meters. This outlines the electrical characteristics, the ballistics characteristics of the meter movement, the wiring diagram, discussion of the reference levels, analysis of what a volume unit means, the two scales used on VU meters, comparisons with the older VI meters and other level indicators, how readings are taken, what the impedance conditions are and how they may need to be adjusted, and reference level terminology.

A 48-page chapter of 173 questions covers motion-picture projection equipment. Not only are the soundtrack and its adjuncts, plus standards, film leaders, etc., described, but even the optical equipment is given some discussion. This includes the lenses, arc lamp, intermittent, screen brightness (the term "luminance" is not used)

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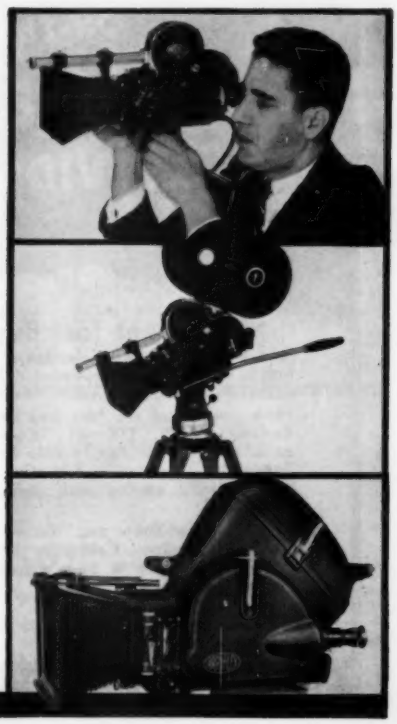

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standards, and the problems of anamorphic and other wide-screen projection. Most of the questions on magnetic tracks are reserved for another chapter.

The level of presentation is aimed at the technician and the more routine engineer, and the language used is kept absolutely as simple as possible. It must be said however that occasionally some probing into the nature of an effect or of a device, though adding some complication, could contribute clarity. To give an illustration, a Rayleigh disc is described as "a device used for measuring sound pressures. Invented by Lord Rayleigh, it consists of a small disc supported by a quartz fibre. The pressure is determined by the twisting action of the disc when subjected to sound pressure." It is possible that a reference to the phenomenon discovered by Lord Rayleigh, that such a disc tends to set itself normal to the direction of fluid flow and pressure, and that this tendency is what is used to measure the pressure, would clarify the description for the neophyte.

Another illustration lies in the discussion of the use of negative feedback. Some 10 pages and 32 questions are devoted to this, and even touch on stability and phase, but nowhere is the Nyquist stability criterion mentioned. A brief diversion in this direction could certainly give the reader a much sounder background on the technique.

It must be said in this regard that considerable reference is made to the literature (much of which is in the *SMPTE Journal*).

Some definitions are really suspect, such as "Critical Damping — The rate of change between periodic and aperiodic damping," and "Aperiodic Damping — A system which oscillates about the final position before coming to a complete rest."

Nevertheless, these things do not really loom up large in the tremendous array of material that is presented in one handy volume. The book should find a ready use among the many technical people who have tasks in the field of sound.—*Pierre Mertz*, Lido Beach, L.I., N.Y.

The third decennial Index of the *Journal of the Acoustical Society of America*, 335 E. 45 St., New York 17, is scheduled for publication late this summer. The 1100-page volume will contain three sections: (1) Author and Subject Indexes to papers published in *J. Acoust. Soc. Am.* during the period 1949–1958 inclusive. (2) Author and Subject Indexes to contemporary papers on acoustics published in many other journals and listed in the *J. Acoust. Soc. Am.* (approximately 13,500 references). (3) Inventor, Subject and Numerical Indexes to acoustical patents reviewed during 1949–1958 (approximately 4000 patents). Prepublication price is $15.00. After the publication date the Index will be priced at $20.00.

The American Society for Testing Materials, 1916 Race St., Philadelphia 3, has announced publication of the 1959 Supplements to the *1958 Book of ASTM Standards*. Each Part-supplement brings up to date the corresponding Part of the 1958 Book of Standards by including new standards and revisions adopted in 1959. Published triennially, Supplements to the Book of ASTM Standards are issued in the intervening years. More than 2600 standard specifications, methods of test, recommended practices and definitions of terms for materials are included.

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current literature

The Editors present for convenient reference a list of articles dealing with subjects cognate to motion-picture engineering published in a number of selected journals. Photostatic or microfilm copies of articles in magazines that are available may be obtained from The Library of Congress, Washington, D.C., or from the New York Public Library, New York, N.Y., at prevailing rates.

American Cinematographer vol. 41, Jan. 1960

Why the 35/32mm Method Results in Better 16mm Prints (p. 34)

Product Report on the Pathé "Webo M" 16mm Camera (p. 36)

A Light Unit that Mounts Anywhere (p. 38) *F. Foster*

The Need for Creativity in Nontheatrical Cinematography (p. 45) *C. Loring*

Russia's Circular Kinopanorama (p. 46) *A. Voyce*

vol. 41, Feb. 1960

Shooting with the New Eastman High-speed Reversal Color Film (p. 98)

A Synchronous Quarter-inch Tape System for Film Sound Recording (p. 102) *G. M. Galloway*

Cinematography in Ophthalmology (p. 106) *J. C. Oberly*

Degrees Kelvin Versus Mireds in Color Temperature Evaluation (p. 111) *D. Norwood*

vol. 41, Mar. 1960

Why Edge-Numbering Pays Dividends (p. 164) *H. Titelbaum*

Sharp Focus Safety with Hyperfocal Distance (p. 168) *J. Forbes*

Protective Shield for Wildlife Photographers (p. 170) *R. Zeper*

Lip-Sync Sound With Any 16mm Camera (p. 172) *J. V. Mascelli*

Why Renoir Favors Multiple Camera, Long Sustained Take Technique (p. 176) *J. Belanger*

The Auricon Super-1200, Pt. VIII (p. 180)

vol. 41, Apr. 1960

Sound Stage Sea Saga (p. 228) *J. Ruttenberg*

Filming *La Dolce Vita* in Black-and-White and Wide-Screen (p. 234) *L. Grandi*

Similarities and Differences in 16mm and 35mm B&W Printing (p. 235)

A Synchronous Quarter-inch Tape System for Film Sound Recording, Part 2 (p. 236) *G. M. Galloway*

Colortran-Lightweight Set-Lighting Package (p. 240)

A Sound System for Sixteen-MM (p. 244) *J. P. Gray*

Bild und Ton vol. 13, Mar. 1960

Zur Geschichte des Agfacolor-Verfahrens (III) (p. 68) *K. Meyer*

Neue Kinoprojektionsobjektive (p. 78) *R. Tiedeken*

British Kinematography vol. 35, Nov. 1959

The New Philips Type FP20S Projector and Type SPP Light Source (p. 112) *W. J. M. Jansen*

Progress in Colour Duplicating Techniques (p. 125) *F. P. Gloyns*

vol. 35, Dec. 1959

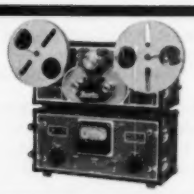
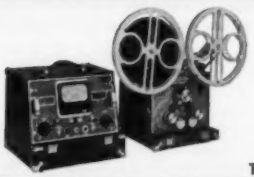
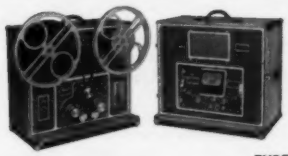
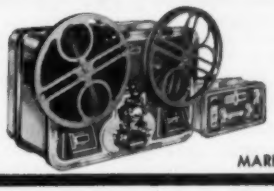
Colour and the Box Office (p. 140) *R. A. Leeks*

Control Engineering vol. 7, Apr. 1960

New Process Develops Movie Film in 60 Seconds (p. 25)

*How to select a recorder to start your MAGNASYNC-MAGNAPHONIC SOUND SYSTEM

Sound Equipment Checklist

		LIGHTWEIGHT	MEDIUM WEIGHT	16 MM FILM	17½ MM FILM	35 MM FILM	REWIND	FOOTAGE COUNTER	POWER AMPLIFIER	MONITOR SPEAKER	TORQUE MOTORS	PLUG-IN AUDIO	PUSH BUTTON CONTROL	REMOTE CONTROL	SLIDE-WIRE POTS	FILM MONITOR	SYNKINETIC MOTION	PLUG-IN HEADS
 X-400	When lightweight portability is a **must** the 27 lb. X-400 Type 1 is the answer! Another reason so many producers choose this machine is that it is genuinely professional, and yet, surprisingly economical! From $985.	X		X			X	OPTIONAL	OPTIONAL	OPTIONAL						X	X	OPTIONAL
 TYPE 1	The Type 1 is a miniaturized version of the Type 5. Low power consumption and extreme portability has made this 39 lb. unit a popular selection for remote location production by leading professional motion picture studios. From $1360.	X		X	X		X	X	X	OPTIONAL		X				X	X	OPTIONAL
TYPE 15	The X-400 Type 15 is designed for the man who wants everything in one case . . . playback amplifier, monitor speaker, footage counter and torque motors. You can be proud to have this machine represent you on any sound stage! From $1385.		X	X			X	X	X	X	X					X	X	OPTIONAL
 TYPE 5	The most popular magnetic film recorder in the world is the Type 5! With this unit and all its operational conveniences, you are definitely in the "major league." The Type 5 owner always starts his pictures with a special feeling of confidence in the realization that he has allowed no compromise in the selection of equipment. From $1570.		X	X	X	X	X	X	X	X	X	X				X	X	OPTIONAL
 MARK 1X	There is nothing on the market that compares with the remarkable Mark 1X. This unit is in a class by itself . . . with push-button remote controlled relay functions, plug-in audio elements and all the "extras" that make for flawless recording under the most adverse conditions. From $2145.		X	X	X	X	X	X	X	OPTIONAL	X	X	X	X	OPTIONAL	X	X	OPTIONAL

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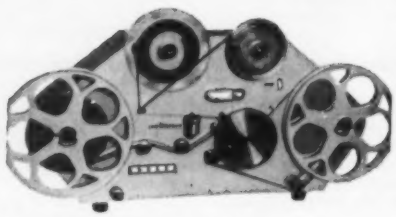

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International Projectionist vol. 35, Jan. 1960

Color Films Draw Better, British Survey of Preferences Indicates (p. 10)

Front-Surface Mirrors: Their Structure, Function, and Care (p. 14)

New High-Speed Color Film Introduced by Eastman Kodak — Has 160 Index (p. 22)

vol. 35, Feb. 1960

Correcting Distortions in Theatre Projection (p. 5) *R. A. Mitchell*

An Analysis of Various Methods for Minimizing Aperture Heat in Projection (p. 12) *H. H. Schroeder*

vol. 35, Mar. 1960

Large-Area Frames and Picture Quality (p. 5) *R. A. Mitchell*

Kino-Technik vol. 14, Jan. 1960

Stand und Entwicklungstendendenzen der Filmaufnahmetechnik (p. 1) *E. Leistner*

Die Technik der Theater-und Fernseh-Filmbearbeitung (p. 4) *A. Kochs*

Der technische Stand moderner Filmwiedergabe (p. 6) *H. Tümmel*

Die Zukunft des Kinefilms (p. 10) *W. Behrendt*

Bild- und Tonanlagen für Fernsehstudios (p. 13) *H. Friess*

Neue Technik der Farbreproduktion oder neue Theorie des Farbensehens? (p. 17) *M. Richter*

Die ersten deutschen 8-mm-Spiegelreflexkameras (p. 19)

Der Universalprojektor U 99 von Frieseke & Hoepfner (p. 21)

vol. 14, Feb. 1960

Studiotechnik im Wachstum (p. 31) *F. Winckel*

Moderne Studiotechnik (p. 32) *O. Diciol*

Die kombinierte MagOptical-Kopie (p. 36) *R. Frenk*

Die Abteilung Tontechnik der Realfilm (p. 39) *R. Fehrmann*

vol. 14, Mar. 1960

Drahtlose Ubertragungsverfahren für Stereophonie (p. 65) *G. Janus*

Die zeitgemässe Kine- und Schmalfilmentwicklung (p. 67) *E. Mutter*

Rückprojektion am Tricktisch (p. 71) *F. Krautschneider*

Normung beseitigt Spulen-Wirrwarr (p. 77) *H. Tümmel*

Die Xenon-Hochdruck- und -Hochdruck-Langbogenlampen und ihre Bedeutung in der Praxis (p. 81) *R. Lehmann*

Aus der Geschichte der Kinematographie (p. 88) *H. Tümmel*

Philips Technical Review

vol. 21, No. 2, 1959/60

A Wide-Band Triode Amplifier with an Output of 10 W at 4000 Mc/s (p. 41) *J. P. M. Gieles and G. Andrieux*

Experiments in the Field of Parametric Amplification (p. 47) *B. Bollée and G. de Vries*

Modern Acoustical Engineering, II. Electro-Acoustical Installations in Large Theatres (p. 52) *D. Klein*

Photo-Technik und Wirtschaft

vol. 11, Feb. 1960

Das laufende Band zum stehenden Bild (p. 30) *F. Karwen*

Fortschritte in der 8-mm-Bild- und Tonwiedergabe (p. 34) *H. Thiele*

Proc. Institution Electrical Engineers

vol. 107, Pt. B, No. 31, Jan. 1960

The Performance of a Balanced Aerial When Connected Directly to a Coaxial Cable (p. 21) *G. D. Monteath and P. Knight*

An Analysis of a Type of Comb Filter (p. 39) *A. G. J. MacFarlane*

The Measurement of Atmospheric Radio Noise by an Aural Comparison Method in the Range 15–500 kc/s (p. 53) *J. Harwood and B. N. Harden*

A Coaxial Film Bolometer for the Measurement of Power in the U.H.F. Band (p. 67) *I. A. Harris*

RCA Review vol. XX, No. 4, Dec. 1959

Electroluminescence of Polycrystallites (p. 532) *S. Larach and R. W. Shrader*

The Achievement of Maximum Photoconductivity Performance in Cadmium Sulfide Crystals (p. 564) *R. H. Bube and L. A. Barton*

Infrared Photoconductive Detectors Using Impurity-Activated Germanium-Silicon Alloys (p. 599) *G. A. Morton, M. L. Schultz and W. E. Harty*

Sintered Cadmium Sulfide Photoconductive Cells (p. 635) *C. P. Hadley and E. Fischer*

Role of Space-Charge Currents in Light Amplifiers (p. 648) *A. Rose and R. H. Bube*

A Simplified Theory of Two-Carrier Space-Charge-Limited Current Flow in Solids (p. 682) *M. A. Lampert*

A Review of Electrofax Behavior (p. 753) *J. A. Amick*

A Volume-Charge Capacitor Model for Electrofax Layers (p. 770) *J. A. Amick*

Abstracts

Abstracts from other Journals, chosen for importance and timeliness, are published in the *Journal* from time to time. The greater number of these abstracts are translations, chiefly from the U.S.S.R., and made available by the *Kodak Monthly Abstract Bulletin.*

AERIAL PHOTOGRAPHY

The Influence of Atmospheric Smoke on the Contrast of Aerial Photographs Taken From Great Heights and With Wide Viewing Angles

An automatic aerial camera for taking photographs from great heights and with wide viewing angles is described. The basic part of the apparatus is a camera with a 400mm, *f*/6.3 objective. Photographs were obtained on a cloudless day in August on Panchrom X Film (sensitivity, 1000 GOST units) with a ZhS-18 Filter. The exposure time was 1/300 sec at *f*/8. It is said that high-quality pictures were obtained. (S. C. G.)—[Translated from *Tekh. Kino i Televideniya*] E. F. Yudin and N. M. Federova. *Optiko-Mekh. Prom.*, pp. 10–13, No. 3, 1959.

CAMERAS AND EQUIPMENT (except High-Speed)

A Universal Portable Device for Shooting Tests on Motion-Picture Cameras

The device consists of a tube which fits into the lens mount of the camera and which contains an objective at a distance of twice the focal length from the plane of the film and a test object at twice the focal length from the objective on the other side, with a light source behind the test object. Methods for carrying out a number of different tests on the camera with the apparatus are described. (S. C. G.)—O. I. Reznikov. *Tekh. Kino i Televideniya*, pp. 73–5, Nov., 1959.

Czechoslovak Motion-Picture Apparatus

A survey of the products of the Czechoslovakian motion-picture industry includes descriptions of 8mm motion-picture cameras for amateur use, professional motion-picture cameras, projectors, sensitometric

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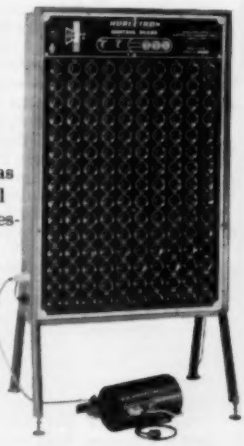

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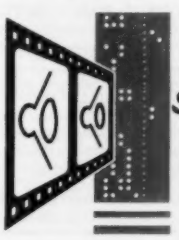

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apparatus, lighting equipment, and sound-recording apparatus. (S. C. G.)—I. Struska. *Tekh. Kino i Televideniya*, pp. 69–74, Sept., 1959.

Cellulose Acetophthalic Esters as Film-Forming Lacquer Layers

Descriptions and results are given of experimental work, the object of which was to determine the feasibility of using cellulose acetatephthalate as a film-forming pigmented-lacquer layer on motion-picture film (antihalation and protective); it is easily washed off in processing the film in alkaline photographic solutions. (S. C. G.)—[Translated from *Tekh. Kino i Televideniya*] L. V. Rozental and O. K. Smirnov. *Trudy Vsesoyuz. Nauch.-Issled. Kinofotoinst.*, pp. 101–04, No. 4 (27), 1958.

Study of the Properties of Cellulose Ester Film Base at Low Temperatures

A report is given of a study of the frost-resistance properties of bases made from various cellulose esters and the alteration in these properties following the introduction of plasticizers into the composition of the base and coating single on it. (S. C. G.)—[Translated from *Tekh. Kino i Televideniya*] G. V. Avilov and E. K. Podgorodetskii. *Trudy Vsesoyuz. Nauch.-Issled. Kinofotoinst.*, pp. 54–65, No. 4 (27), 1958.

Methods of Determining the Safety of Motion-Picture Film

The results of work on the determination of a quantitative safety index for film are reported. The properties of Soviet-produced acetate and triacetate films and those of some samples of foreign safety film have been confirmed, and compared with the analogous properties of nitrocellulose film. (S. C. G.)—[Translated from Tekh. Kino i Televideniya] G. V. Avilov, D. M. Yuzhnaya, and E. K. Podgorodestkii. *Trudy Vsesoyuz, Nauch.-Issled. Kinofotoinst.*, pp. 149–54, No. 4 (27), 1958.

FILM PROCESSING APPARATUS AND CHEMICALS

The Development of Films From Television Recording With Divalent Vanadium Ions

In the rapid development of cinematograph film generally carried out with the aid of a strongly alkaline Metol-hydroquinone developer, e.g., with caustic soda, at a high temperature, there is an increase in grain and a lowering of the speed of the emulsion, which is particularly noticeable in the case of 16mm film. The paper describes a developer with V^{2+} ions which exhibits considerable advantages over earlier ones in this connection. The time of development, when it is used, is 20 sec at a temperature of 15 C instead of 5 min at 20 C with Metol-hydroquinone. The starting material used for vanadium development is V_2O_5, from which is obtained the 4-valent vanadium compound which is reduced by electrolysis to the divalent vanadium salt. The process of development of the film by vanadium ions may be represented by the equation,

$$V^{2+} + Ag^{+} \rightarrow V^{3+} + Ag.$$

The V^{3+} ions exhibit a very slight developing power, but may be electrolytically re-

duced again to the V^{2+} ion. In this way, the vanadium developer is easily regenerated. A disadvantage of development in a new developer is the instability of the process because of the tendency of the developer to oxidation by atmospheric oxygen, and hence the electrolysis apparatus and the whole circulation system must be completely isolated from the air. The degree of activity of the developer is shown, as is well known, by its oxidation-reduction potential. In the case of a new developer, the ions V^{4+}, V^{3+}, V^{2+} possess the spectral characteristics of their oxidation-reduction potentials. The activity of the developer is determined according to the increased speed, obtained by controlling the spectral characteristics of the vanadium ions. The suitability of the vanadium developer for high-speed development of photographic film was confirmed in newly constructed automatic developing machines still requiring some improvements. (S. C. G.)—[Translated from *Referativnyi Zhur., Fiz.*] K. Takushiro. *Tech. J. Japan Broadcast Corp.*, pp. 19–26, No. 32, 1957 (in Japanese).

Study of a Section of a Multiple-Loop Film-Transport Mechanism, in Which the Upper Axle Is Fixed, While the Lower Axle Is Turned by a Friction-Drive Roller

The results are set out for the study of a section of a film-transport mechanism applied to three cases: (1) in which the upper and lower axles with rollers are set in air; (2) in which the upper axle roller is set in air, and the lower is set in a photographic solution; and (3) in which the upper and lower axles with rollers are set in a photographic solution. For all three cases, calculations were made and curves were obtained showing the change of tractive forces on the film in the film-transport mechanism. (S. C. G.)—[Translated from *Tekh. Kino i Televideniya*] I. S. Golod. *Informatsionnotekh. Byull. TsKB Minist. Kultury S.S.S.R.*, pp. 7–16, No. 3 (7) [or 17?], 1958.

The 71P-1 Film-Restoring Machine

A report is given of the development of a new type of film-restoring machine, the 71P-1, intended for restoration and protective treatment of both sides of black-and-white and color film prints, 35 mm and 16 mm, under the conditions of district and regional hiring. The machine may be used for the general treatment or for specific operations by using the required units only: viz., cleaning the emulsion layer and base, restoration of damaged picture layer or base, and their treatment. Constructional details of the machine are given. The method of loading, the kinematic lay-out, and the electrical circuit are outlined. (S. C. G.) [Translated from *Tekh. Kino i Televideniya*] V. F. Golosov. *Informatsionnotekh. Byull. TsKB* Minist. Kultury S.S.S.R. pp. 3–6, No. 3 (17) [or (7)?], 1958.

FILM PROCESSING APPARATUS AND CHEMICALS

Automation of the Regeneration of Fixing Solution and Electrolytic Deposition of Silver in the Processing of Motion-Picture Film in Developing Machines

A detailed description is given of a fully automatic unit for the electrolytic precipitation of silver from a fixing solution which is continuously circulated in a developing machine. In addition to the removal of silver, the unit automatically provides for the replenishment of the sodium thiosulfate.—(S. C. G.)—A. I. Kalinikos and N. I. Snyatkov. *Tekh. Kino i Televideniya*, pp. 1–12, Oct., 1959.

A Study of the Possibility of Increasing the Photographic Speed of Panchromatic Films by Means of Cyclic and "Starved" Development

High-speed panchromatic films give their best detail-rendering with a gamma of 1.7, but when developed to this gamma, some films show speeds three to four times below the nominal. In order to raise the film speed while developing to this particular gamma, cyclic and "starved" development have both been tried. In cyclic development, the film is passed through the developer, rewound, and left for a short while, this cycle being repeated as often as required (in this case three times.) For a given gamma, the speed was raised by this method 20 to 40 per cent in comparison with normal development. In addition, the film was developed more uniformly along its length. "Starved" development consists in soaking the film until saturated in the developer at a low temperature, removing it, and leaving it until development is complete. This form of development gave an increase in speed of about twice for a given gamma. The latitude of the film was also increased approximately twice, and there was an increase in the maximum density. Recommended formulas for starved development are given. (S. C. G.)—K. I. Markhilevich and V. L. Abritalin. *Zhur. Nauch. i Priklad. Fotografii i Kinematografii, 4:* 433–37, No. 6, Nov.-Dec. 1959.

The Calibrated and Uniform Application of Processing Solutions to Continuously Moving Film

Consideration is given to the fundamental conditions which ensure a calibrated and uniform application of processing solutions to a continuously moving film. On the basis of the derived equations, it is shown how the volume of a solution applied to the film depends on different factors arising in the use of different types of apparatus with dip-coating rollers, transfer-coating rollers, etc. The action of wetting agents in the application of processing solutions to the continuously moving film is considered, and the conditions are indicated for obtaining their uniform distribution over the surface of the film. In the experimental part of the paper, a study is made of the action of different wetting agents on the uniformity of application of developing and fixing solutions to the film. [Translation of Authors' Abstract] (S. C. G.)—S. M. Levi, N. J. Maslenkova, and N. I. Kirillov. *Tekh. Kino i Televideniya*, pp. 18–25. Dec., 1959 (in Russian).

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COLOR PHOTOGRAPHY

DS-3 Color Negative Motion-Picture Film

A new, improved color negative film has been developed by the research institute, NIKFI, in collaboration with one of the Soviet film factories. It is a daylight-type film, like the earlier DS-2 Film. The DS-3 has only the three emulsion layers, differing from the DS-2 in that the colloidal silver layer has been replaced by dyeing the top, blue-sensitive, layer yellow. It has improved color rendition, owing to the use of a better magenta coupler, and improved resolving power due partly to the yellow dye and partly to a higher silver/gelatin ratio than that in the DS-2 and a corresponding decrease in thickness of the emulsion layers. Speed has been doubled, but other sensitometric characteristics remain the same. (S. C. G.)—I. M. Kilinskii, Yu. B. Vilenskii, and A. N. Iordanskii. *Tekh. Kino i Televideniya*, pp. 15–17, Aug. 1959.

New Type Make-Up Material for Color Motion Pictures and Color TV

Skin-color types are analyzed colorimetrically as part of an evaluation of a new cosmetic make-up, called "High-con Color Stick," (Japanese Color Research Institute) which is intended for use in the production of professional motion pictures. (W. F. W.)—*Mot. Pict. Engineering J.* (Japan), pp. 1–8, No. 81, Aug., 1958. (Translation T-2921.)

General

Speeding-Up Technical Progress and the Introduction of Advanced Techniques into Cinematography and the Cinema Industry

The present phase in Soviet economic and cultural development requires a considerable extension of motion-picture photography. A number of points are discussed on which effort is to be concentrated. The use of 70mm film is to be greatly extended and its production is to be increased by a factor of 4.4. The development of magnetic picture recording is to have high priority. Every effort is to be made to introduce rationalization, mechanization, and automation into the manufacture of film, into the film studios, and into the cinemas. Film-printing laboratories are to increase their capacity, and once again automation is stressed; the control of quality should be much improved by automatic methods. The imbibition printing of color-film prints is to be greatly extended, and multilayer color-negative films containing masking couplers are to be improved to give better color rendering and sharpness.

The effects of these problems on the work of the research institutes, especially NIKFI, and the factories are discussed. (S. C. G—V. G. Komar. *Tekh. Kino i Televideniya*, pp. 1–6, Nov. 1959.

HIGH-SPEED PHOTOGRAPHY

Calculation of an Optical System for Combining a High-Speed Cine Camera With Shadow and Interferometric Apparatus

E. A. Tarantov. *Zhur. Nauch. i Priklad. Fotografii i Kinematografii, 4:* 375–79, No. 5, Sept.-Oct. 1959.

The 1-KSK Motion-Picture Camera for High-Speed and Special-Effects Cinematography

The Soviet 1-KSK motion-picture camera operates at rates as high as 132 frames/sec on a single film, or 96 frames/sec on two films in special effects work. Other types of special effects are also possible. The mechanics and optics of the camera are described. (S. C. G.)—G. A. Shmidt. *Tekh. Kino i Televideniya*, pp. 55–9, Aug. 1959.

Synchronizing Apparatus for the RKS-1 High-Speed Camera and a Taking Speed Meter

A circuit is given for synchronizing the Soviet RKS-1 high-speed camera with electronic flashlamps. The taking-speed meter described measures the speed of rotation of the camera mirror by electromagnetic means. (S. C. G.)—V. P. Gusev, A. S. Zingerman, and S. M. Provornov. *Tekh. Kino i Televideniya*, pp. 13–17, Sept. 1959.

OPTICS

A Photoelectric Microphotometer for Testing Photographic Objectives

There are several characteristics which govern the quality of an optical image; among these the frequency-contrast characteristic has received the widest use. By frequency-contrast characteristic of an objective is understood the characteristic of the image quality and the characteristic of the objective for a certain range of frequencies in the image of a sinusoidal test object.

A layout is given for a laboratory photoelectric microphotometer for determining the contrast of an optical image, consisting of an optical bench and a photoelectric measuring device. Results of measurements are given. (S. C. G.)—[Translated from *Tekh. Kino i Televideniya*] A. T. Ashceulov, T. A. Pavlichuk, and M. D. Khukhrina. *Optiko-Mekhanicheskaya Prom.*, pp. 4–7, No. 6, 1959.

The Accuracy Required in Making Kinematic Layouts for Certain Objectives With Variable Focal Lengths

The article is devoted to the solution of the following problems: (1) the determination of the tolerances necessary in making a kinematic system; and (2) the calculation of corrections for the coefficients of the equation of motion after the preparation of the separate components of the setup.

Values are worked out for the angles of a paraxial beam, calculated for a determined set of conditions, and the value of tolerances on displacement of the separate components. (S. C. G.)—[Translated from *Tekh. Kino i Televideniya*] M. S. Stefanskii. *Optiko-Mekhanicheskaya Prom.*, pp. 11–13, No. 8, 1959.

New Developments in Cinematographic Optics and the Immediate Tasks in This Field.

This survey is limited to recent cinematograph objectives produced in the Soviet Union by GOI (State Optical Institute), the Central Constructional Bureau of the Ministry of Culture of the Soviet Union, and LIKI (Leningrad Institute of Motion-Picture Engineers). The types of objectives covered are: (1) fast, short-focus, wide-angle, anastigmats with a large back focal length; (2) fast, long-focus telephoto objectives; (3) improved objectives with normal optical characteristics; (4) anastigmats for general, wide-screen, and panoramic projection; (5) anamorphic optical systems for wide-screen cinematography; and (6) fast, wide-angle anastigmats for cinematography on wide-gauge film. (S. C. G.)—D. S. Volosov. *Tekh. Kino i Televideniya*, pp. 1–12, Sept, 1959.

PROJECTION

The Focusing of a Projection Lens and the Angle of Projection

A curve shows the relation between the displacement of a motion-picture projection lens for focusing, its focal length, and distance from the screen, and formulas are derived for calculating the dimensions of a screen for inclined projection. (S. C. G.)—[Translation of *Referativnyi Zhur., Fiz.*] *Motion Picture Engineering Rep.*, pp. 12–13, No. 88, 1957. (In Japanese.)

The Problem of the Conditions for the Perception of Motion-Picture Images

Analysis is made of the conditions necessary in a motion-picture auditorium to give the viewer as natural an impression of the subject imaged as possible. It is concluded that, apart from a full stereoscopic presentation, the panoramic forms, with either three separate films or a single wide film, meet these conditions to a very high degree. (S. C. G.)—E. M. Goldovskii. *Tekh. Kino i Televideniya*, pp. 13–23, Oct. 1959.

Method of Evaluating the Quality of Stereoscopic Projection on a Grid-Type Stereoscopic Screen

The quality of grid stereoscopic screens is determined by the dimensions of the working region for the central and size zones of stereoscopic vision and the magnitude of the coefficient of separation of the images of the stereographic pair. The magnitude of the separation coefficient depends not only on the quality of the lenticular screen but also on the reflecting surface and on the adjustment of the grid with the reflecting surface. The coefficient of separation is a characteristic of the quality of perception of a stereo image and the parameters of the working region of the zone determine the degree of ease of perception of a stereo image on a grid stereoscopic screen. (S. C. G.)—[Translaion of Author's Abstract] L. V. Akimakina. *Zhur. Nauch. i Priklad. Fotografii i Kinematografii, 4:* 363–66, No. 5, Sept./Oct. 1959.

A Method of Calculation for Elliptical Polished Reflectors for Motion-Picture Projectors

A method is described for calculating the change in thickness of a reflector glass on polishing, allowing the calculation of aberrations up to practically insignificant values. This gives the possibility of a simple method of polishing and preparing a high-quality reflector with a large collecting angle. The method set out has great importance in the wide application of the new light sources—the spherical xenon high-pressure lamps—in motion-picture projection. (S. C. G.)—[Translated from *Tekh. Kino i Televideniya*] G. A. Golostenov, A. N. Lazareva, and Ts. I. Ezrokhi. *Trudy Vsesoyuz. Nauch.-Issled. Kinofotoinst.*, pp. 5–23, No. 30, 1959 (in Russian.)

Influence of the Finish of Sprocket-Teeth Surfaces on the Wear of Film Perforations

Curves showing the wear on perforations by sprocket teeth with different milling finishes are presented. [Abstractor's Note: Since the finishes are given the designations prescribed in a Russian Standard, it is not possible to translate the results in terms of British practice in the absence of that Standard.] (S. C. G.)—S. M. Pertsev. *Tekh. Kino i Televidenya*, pp. 50–4, Sept. 1959.

One or Three Lenses for the Panoramic Cinema?

The author regards panoramic cinematography with a curved screen as superior to wide-screen systems. A comparison is made between the systems using three separate cameras and projectors (Cinerama in the United States and Kinopanorama in the Soviet Union) and the Todd-AO system which uses only one camera and one projector, and requires a wide-angle lens and 70mm film. It is concluded that the three-lens system is the more desirable of the two, and that the wide-format system can only be regarded as an improved, but more expensive, version of the wide-screen system. (S. C. G.)—A. A. Lapauri. *Tekh. Kino i Televideniya*, pp. 41–5, Sept. 1959.

SOUND RECORDING AND REPRODUCTION

The Theory of Transverse Magnetic Signal Tracks With Varying Intensity

Consideration is given to the problem of the frequency characteristic of the surface induction of a magnetic signal track with varying intensity on a tape carrier, in the

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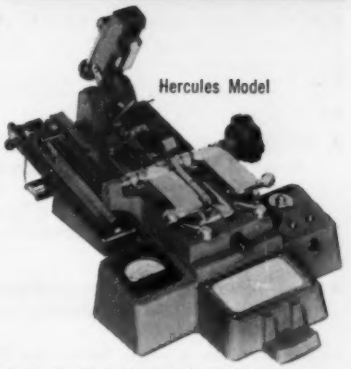

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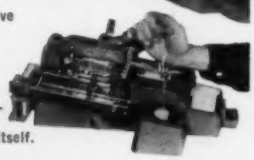

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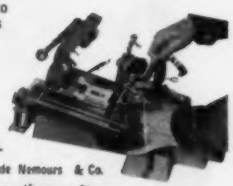

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case in which the tape is magnetized perpendicular to the plane of its working surface. Formulas are derived for calculating the losses occasioned by the self-demagnetization of the transverse signal track. A comparison is made of the frequency characteristics of the surface induction for the transverse and linear systems. (S. C. G.)—[Translation of Author's Abstract] V. A. Geranin. *Tekh. Kino i Televideniya*, pp. 47–50, Oct. 1959.

The Conversion of a Single Channel to a Stereophonic Soundtrack

V. M. Ottochek and A. V. Chernoochenko. *Tekh. Kino i Televideniya*, pp. 51–7, Oct. 1959.

Calculation of a Correcting Link in the Recording Head Circuit of a Magnetic Recorder

I. G. Minaev. *Tekh. Kino i Televideniya*, pp. 62-3, Nov. 1959.

A Method of Determining the Surface Residual Induction of Magnetic Sound Carriers

Yu. A. Vasilevskiĭ and A. S. Popova. *Tekh. Kino i Televideniya*, pp. 36–44, Dec. 1959. (in Russian.)

A Single Technology for Magnetic Sound-Recording in the Production and Dubbing of Art Films

Discussion on a single technology for magnetic sound-recording in the production and dubbing of art films has proceeded in a number of articles in *Tekhnika Kino i Televideniya* during 1959. A commission has been set up by the Ministry of Culture of the Soviet Union (to which the motion-picture industry is responsible) with the task of settling the question of a single system for use through the Soviet studios. The chairman of the commission now puts forward the recommendations. They are based on the use of 35mm magnetic tape at a speed of 456 mm/sec. [18 in/sec], and cover the original recording, methods of editing, transfer to the positive film, and some other points. (S. C. G.)—M. A. Genisaretskii. *Tekh. Kino i Televideniya*, pp. 46–9, 1959.

TELEVISION

Method of Compensating for Uneven Film Movement in [Television] Systems With A Flying-Spot Tube

In apparatus for television transmission or cinematography of television images, departures of the film-transport speed from the average cause a falling-off of the definition of the television image and variation in the mean position of the television raster. The method proposed allows for compensation of the uneven motion of the film with the aid of supplementary vertical displacements of the television raster proportional to the integral of the varying component of tension of a film-speed indicator. (S. C. G.)—[Abridged translation from *Tekh. Kino i Televideniya*] Russian 115, 127. G. V. Braude. Filed July 7, 1956.

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Journals Available/Wanted

These notices are published as a service to expedite disposal and acquisition of out-of-print Journals. Please write direct to the persons and addresses listed.

Available

Complete file, Vol. I No. 1 through Dec. 1959 with indexes. Fine condition: $500. James G. Barrick, 15726 Fernway Ave., N.W., Cleveland 11, Ohio.

Complete set of Transactions, except Nos. 6 and 9, and all Journals published to date, including indexes. All in good condition. Price $500. Also extra copies of Transactions Nos. 21, 31, 32. W.W. Hennessey, RFD #2, Pound Ridge, N. Y.

Complete set of Journals from May 1937 to June 1954, including special volumes and membership directories, excellent condition; also Mar., May 1934 and July 1935 issues. Write: Harry R. Lubcke, 2443 Creston Way, Hollywood 28, Calif. HO 9-3266.

Jan.-Dec. 1950; Jan., Feb., Apr.-Dec. 1951; Jan.–Mar. 1952. Also available are vols. 6 and 7 of The Television Society (British) covering the period Jan. 1950 through Sept. 1955. Write: Andrew N. McClellan, 65 Hillside Drive, Toronto 6, Ont., Canada.

Dec. 1946, Feb.–Dec. 1947, 1948–1955 complete. All copies in perfect condition; for sale as entire lot only. Write: Joseph W. MacDonald, 2414 Sullivant Ave., Columbus 4, Ohio.

Jan. 1947 to Dec. 1957 complete and in perfect condition. For sale only as a set. Write: Charles J. Marshall, 2816 Royalston Ave., Kettering, 19, Ohio.

Complete set of Journals Jan. 1949 to Dec. 1958. Perfect condition. What offers? Write: J. G. Jackson, 210 Kingsway South, Port Alberni, B.C., Canada.

Assortment of Journals, from 1937 through 1950. Write: Alan Cook, South Londonderry, Vt.

Wanted

Jan. 1938. E. Raymond Arn, Film Associates, Inc., 4600 S. Dixie Ave., Dayton 9, Ohio.

Feb., Mar., Apr., June 1934. Mrs. Janet Van Duyn, Librarian, CBS Laboratories, 227 High Ridge Rd., Stamford, Conn.

Journals—Bound volumes. Write: S. P. Solow, Consolidated Film Industries, Inc., 959 Seward St., Hollywood.

Transactions 6 and 9 ($15 each offered). W. W. Hennessey, RFD #2, Pound Ridge, N.Y.

Jan. 1938, Jan. 1949. (Many other issues are available for trade.) Dept. of Cinema, Univ. of Southern Calif., University Park, Los Angeles 7. Att: Herbert E. Farmer.

Transactions No. 1, 1916 ($5 offered); No. 6, 1918 ($10 offered); No. 7, 1918 ($10 offered). James G. Barrick, 15726 Fernway Ave., N.W., Cleveland 11, Ohio.

employment service

These notices are published for the service of the membership and the field. They are inserted three months, at no charge to the member. The Society's address cannot be used for replies.

Positions Wanted

Motion-Picture Technician, Timer. Age 35, 12 yrs experience in all phases laboratory work, processing supervision, sensitometric control, some knowledge camera work and animation. SMPTE member. Desire permanent position with laboratory or TV station. Complete resume on request. Gunter J. Hackert, c/o Oskar Ernst, 213 East 81 St., New York 28.

Cinematographer. 25 yrs experience black-and-white and color, 35 & 16mm; 5 yrs theatrical production in Europe; 20 yrs industrial, commercial, educational and documentary films; recently worked 12 yrs with General Motors Audio-Visual Photographic Dept.; further background information available. Desires connection with producer of industrial, educational or travel films. Free to travel; speak several languages. J.P.H., Box 375, College Park Station, Detroit 21, Mich.

Producer-Manager or Laboratory Production Supervisor. Independent producer in 16mm sound films and industrial and color still photography desires position with large company. No capital to expand plus limited market prompts move. Married, 28 yrs old. B.A. and part M.A. in communications. Experienced PR man. Ex-Marine. Best of references. Owns complete motion-picture and still production and lab equipment. Résumé on request. Write: DH, Box 118, Missoula, Mont.

Television Producer-Director. With a broad background in both educational and network level commercial television. Experience in radio production and sales, and also a knowledge of merchandising. Both B.A. and M.S. degrees. Currently employed, but willing to move to a position where hard work and ability will lead the way to opportunity. Willing to locate anywhere in the U.S. Married. Résumé and references supplied on request. Write: Richard R. Ferry, Apt. 112, 14 Buswell St., Boston, Mass.

Motion-Picture Production Associate. Univ. S. Calif., Dept. of Cinema, graduate, age 26. Experience as cameraman, editor and sound mixer with National Educational Television and Radio Center at Univ. of Illinois Math Study. One yr project ends July 1, 1960. Desire permanent position as cameraman, editor or sound mixer. Resume and references on request. John A. Werner, 317 S. Russell St., Champaign, Ill.

Assistant to Top Executive. Willing relocate or travel. Administrator-Consultant-Technician all phases photo industry USA and abroad. Production, sales and sales promotion; along with extensive processing, recording and editing experience. Planned, erected, installed and operated studios and labs in many locations. SMPTE member some 25 years 10 Brookside Drive, Apt 4D Greenwich, Conn. TOwnsend 9-5090.

Sound Recording Technician. Cuban, 30, married. Over 12 yrs experience all types mixing for radio, television, records and film; recording on tape, disk and 16mm optical; multitrack rerecording and sound reading for animation. Specialist in music recording and tape editing. Employed as sound production consultant with large advertising agency. Desire permanent position in Latin America or U.S. to handle either technical job or sound production for radio and TV advertising. Fluent in Spanish, English and German. Complete résumé on request. Pedro E. Misner, Montero Sanchez 21, Vedado, Habana, Cuba.

Director, Producer, Camerman, Instructor. Practical and admn. experience in educational and TV film production, also in 16mm motion-picture laboratory supervision and still photography. Masters Degree in Cinema, Univ. So. Calif. Present contract as Film Unit Director for the National Education Television Mathematics Film Study, Univ. of Illinois, ends Sept. 1, 1960. Age 32, married. For résumé write or call: Byrl L. Sims, 1102-A West Main St., Urbana, Ill.; EMpire 7-6611, Ext. 3837.

Positions Available

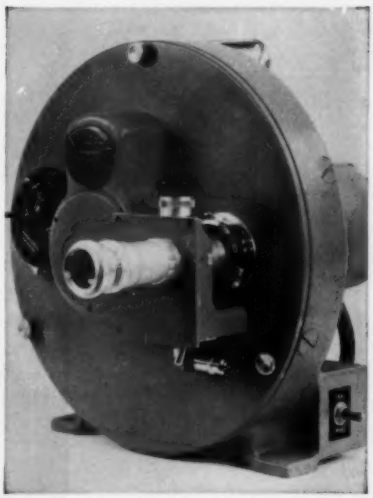
Optical-Photographic Engineers. Excellent opportunities for optical and photographic engineers with or without experience in optical instrumentation, photographic optical systems and cinematography. Mechanical aptitude desired but not required for these engineering positions. Send resume to Ellis P. Faro, c/o Scientific Employment, Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, N. Y.

Photo Chemist/Chemical Engineer. Outstanding, creative opportunity for graduate chemical engineer or photo chemist with broad basic knowledge of processing techniques and solutions including minimum of 2 yrs experience with image transfer materials. Desire ambitious engineer with 10 yrs photographic experience for attractive opening in new product development. East coast location. Our employees know of this ad. Box MPTV 1944, 125 West 41 St., New York 36.

Sound Technician. GS-9, $5985 per yr. Duties involve operation, servicing and maintenance of complete 16mm sound recording system, including making of original magnetic tape recordings, rerecordings and optical recordings. Interested parties should apply by sending a resume or standard Government application form (Form 57) to Industrial Relations Department, Pacific Missile Range, Naval Missile Center, P.O. Box 4, Point Mugu, Calif.

Chief Engineer. To take charge of product development and diversification program for well known manufacturer of tape recorders and audio equipment. Company located in Chicago requires man with strong engineering background and knowledge of audio circuitry. Experience with magnetic recording devices and systems will be helpful but not necessary. Ability to operate at top executive level is essential. Five figure salary and other incentives. Send data on background and experience confidentially to: John M. Watkins, Suite 1604, 28 East Jackson Blvd., Chicago 4, Ill.

Electronic Engineers. Circuits and Systems, Development and Design in fields of Broadcast and Closed-Circuit TV, both Commercial and Military. Transistorized Circuit experience necessary. Fastest-growing company in field. Many benefits. Profit-sharing in ownership available. Foto-Video (Electronics, Inc.,) 36 Commerce Rd., Cedar Grove, N. J. CEnter 9-6100.



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Kodak

He has been a Navy jet jockey, but now he has to make film for observing flying vehicles rarely ridden in.

He became interested in photographic technique while working for Kodak after school, but now he is a customer and a tough one.

J. A. Otto (left) of Kodak meets W. W. Topping at an up-range tracking telescope station. As the man in control of Kodak Linagraph Shellburst Film for cinetheodolites, Mr. Otto has come out from Rochester to the New Mexico desert to describe in detail to Mr. Topping certain changes he has made in the product. They involve hardening of the emulsion for high-temperature processing and an increase in the ratio of red- to blue-sensitivity to increase the precision of measurements on distant orange-painted objects against the blue sky. Mr. Topping is supervisor of the photographic group of Land-Air, Inc., range data-gathering contractors at White Sands Missile Range.

On a busy day, Ward Topping may have to put through film from 18 missile missions, each covered by perhaps 25 cameras along the range. All the footage has to be delivered ready to read by seven the next morning, and the data-evaluation contractor has to like the quality. All John has to do is make the film that goes in the cameras good enough for Ward to like it. It's called **Kodak Linagraph Shellburst Film** and is available to all from Kodak dealers in 16mm, 35mm, and 70mm widths.

Photorecording Methods Division

EASTMAN KODAK COMPANY, Rochester 4, N.Y.

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Meeting Calendar

Institute of the Aeronautical Sciences, National Summer Meeting, Mid-June, 1960, Los Angeles.

Acoustical Society of America, Spring Meeting, June 9–11, 1960, Providence, R.I.

National Society of Professional Engineers, Annual Meeting, June 9–11, 1960, Statler Hotel, Boston, Mass.

International Electronic, Nuclear and Cinematographic Exhibition, June 15–July 5, 1960, Rome Italy.

AIEE, Summer General Meeting, June 19–24, 1960, Atlantic City, N.J.

American Society for Engineering Education, Annual Meeting, June 20–24, 1960, Purdue Univ., West Lafayette, Ind.

First Congress International Federation of Automatic Control, June 25–July 9, 1960, Moscow, U.S.S.R.

American Society for Testing Materials, Annual Meeting and Apparatus Exhibit, June 26–July 1, 1960, Chalfonte-Haddon Hall, Atlantic City, N.J.

Military Electronics Convention (IRE), June 27–29, Sheraton Park Hotel, Washington, D.C.

Medical Electronics, International Conference, July 21–27, Olympia, London, England.

Computers and Data Processing Symposium, July 28–29, Denver Research Institute, Stanley Hotel, Estes Park, Denver.

AIEE, Pacific General Meeting, Aug. 8–12, 1960, San Diego, Calif.

National Audio-Visual Convention, Aug. 6–9, 1960, Hotel Morrison, Chicago

International Astronautical Federation Congress, Aug. 15–20, Stockholm, Sweden.

Western Electronic Show and Convention, Aug. 23–26, Los Angeles.

Electron Microscope Society of America, Annual Meeting, Aug. 29–31, Marquette Univ., Milwaukee, Mich.

European Conference on Electron Microscopy, Aug. 29–Sept. 3, 1960, Delft, Netherlands.

Standards Engineers Society, Sept., Pittsburgh, Pa.

Illuminating Engineering Society, National Technical Conference, Sept. 11–16, Penn Sheraton Hotel, Pittsburgh, Pa.

ASCE, National Convention, Oct. 9–13, Boston, Mass.

Electrochemical Society, Meeting, Oct. 9–13, Shamrock Hotel, Houston, Texas.

AIEE Fall General Meeting, Oct. 9–14, Chicago.

NEC National Electronics Conference, Oct. 10–12, 1960, Hotel Sherman, Chicago.

Optical Society of America, Annual Meeting Oct. 13–15, Somerset Hotel, Boston, Mass.

Fifth International High-Speed Congress and Equipment Exhibit, sponsored by the SMPTE, Oct. 16–22, 1960, Sheraton-Park Hotel, Washington, D.C.

Symposium on Space Navigation, Oct. 19–21, 1960, Columbus, Ohio.

Acoustical Society of America, Fall Meeting, Oct. 20–22, San Francisco.

AIEE, API, ONR, IRE, Metallurgical Society, Sixth Annual Conference on Magnetism and Magnetic Materials, Nov. 14–17, New Yorker Hotel, New York.

ASME, Annual Meeting, Nov. 27–Dec. 2, Statler, Hilton Hotel, New York.

American Association for the Advancement of Science, Annual Meeting, Dec. 26–31, New York.

89th Semiannual Convention of the SMPTE, May 7–12, 1961, King Edward Sheraton, Toronto.

90th Semiannual Convention of the SMPTE, Oct. 2–6, 1961, Lake Placid, N.Y.

91st Semiannual Convention of the SMPTE, Apr. 30–May 4, 1962, Ambassador Hotel, Los Angeles.

92nd Semiannual Convention of the SMPTE, Oct. 22–26, 1962, Drake Hotel, Chicago.

SMPTE Officers and Committees: The rosters of the Officers of the Society, its Sections, Subsections and Chapters and of the Committee Chairmen and Members were published in the April 1960 Journal Part II.

sustaining members

of the Society of Motion Picture and Television Engineers

The objectives of the Society are:

- Advance in the theory and practice of engineering in motion pictures, television and the allied arts and sciences;
- Standardization of high professional standing among its members;
- Maintenance of high professional standing among its members;
- Guidance of students and the attainment of high standards of education;
- Dissemination of scientific knowledge by publication.

Progress toward the attainment of these objectives is greatly aided by the financial support provided by the member companies listed below.

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